NORTH CAROLINA
DEPARTMENT OF CONSERVATION AND DEVELOPMENT
R. BRUCE ETHERIDGE, *Director*

BULLETIN NO. 53

Forest Resource Appraisal
of
North Carolina
(1945)

Survey by:
GEO. K. SLOCUM, *Associate Professor of Forestry, N. C. State College*
CHAS. R. ROSS, *Regional Consultant American Forestry Association*

Cooperating Agencies:

N. C. DEPT. OF CONSERVATION AND DEVELOPMENT
N. C. STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AMERICAN FORESTRY ASSOCIATION

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PUBLISHED BY DIVISION OF FORESTRY AND PARKS
W. K. Beichler
State Forester

DIVISION OF COMMERCE AND INDUSTRY
Paul Kelly
Industrial Engineer

Four Major Forest Problems In North Carolina

1. **Hardwood Succession.** Pine timber made the state's reputation in the lumber world. Later it attracted pulp mills. Pine yields considerably more than hardwoods on most sites but hardwoods are gradually replacing pine. This area in Wake County is now taken over by hardwood trees, sprouts, and culls after two cuttings in the original pine stand.

2. **Widespread Burning in Eastern North Carolina.** This cut-over area in Jones County is typical of several million acres in that fires are not being effectively prevented. Fire protection facilities must be greatly increased. The ground shown in the above picture is covered with pond pine seedlings and sprouts. They would re-stock the area very well if continual burning were stopped.

3. **Removal of Pine Seed Sources.** Pine will often reseed an area after cutting if trees are left to scatter seed. More and more cuttings today fail to leave seed trees, as on the above area in Bladen County. It will be necessary to plant pines here to establish a worthwhile forest. The hardwoods now coming up will be worth little, if anything, on this poor, sandy site.

4. **Accumulations of Hardwood Cull Trees and Brush.** Timber companies at present have very little use for hardwood trees that will not make sawlogs. Regeneration of desirable sawtimber in areas of this type is impossible, unless the unwanted overwood can be disposed of in some manner. Currituck County.

FOREWORD

The Forest Resource Appraisal is a project of nation-wide scope, organized by the American Forestry Association early in 1944. It is a fact-finding survey to determine the effects of the war period upon the country's forests, their productive condition, and to study means of improving these conditions. The Board of Directors of the Association decided on the project in 1942 and funds were contributed in 1943 and 1944 by over 500 organizations, industrialists, and individuals alert to the need for forest conservation and development in the post-war economy. John B. Woods was appointed Director of the National Project.

This effort on the part of the American Forestry Association was in turn matched by forestry and planning agencies within the various states. Dr. J. V. Hofmann, Director of the N. C. State College Division of Forestry; W. K. Beichler, State Forester, and J. S. Holmes, Associate State Forester, arranged for the cooperation of their organizations.

The North Carolina Forest Resource Appraisal was begun in March, 1945. The work was carried out under a cooperative agreement between the North Carolina State College Division of Forestry, the Division of Forestry and Parks and Division of Commerce and Industry of the N. C. Department of Conservation and Development, and the American Forestry Association.

The Department of Conservation and Development furnished one man, James Roberts, Washington, D. C., as an office computer, and is publishing this report as its chief contribution to the project. Opinions, conclusions, and statistical data expressed herein are not necessarily endorsed by this Department.

All field work and the development of the report was done by the authors.

Appreciation is expressed to the North Carolina Crop Reporting Service, the U. S. Soil Conservation Service, the U. S. Agricultural Adjustment Administration, the Tennessee Valley Authority and the Forest Survey of the U. S. Forest Service for valuable assistance in the survey. Inclusion of information from the U. S. Forest Survey is frequent in this report.

TABLE OF CONTENTS

NORTH CAROLINA FORESTRY FACTS

Total area of the state	52,712 sq. mi.	33,735,680 acres
Total water area	3,570 sq. mi.	2,284,800 acres
Total land area	49,142 sq. mi.	31,450,880 acres
Total forest area	29,502 sq. mi.	18,797,245 acres

Public Ownership of Forest Land

National Forests, U.S.F.S. Dept. of Agriculture	965,766 acres	5.14 per cent
National Parks, Dept. of Interior	249,977 acres	1.33 per cent
Other Federal	396,594 acres	2.12 per cent
N. C. State Forests	40,000 acres	0.22 per cent
N. C. State Parks	10,910 acres	0.05 per cent
N. C. State Game Refuges and Farms	80,645 acres	0.42 per cent
County and Municipal Forests	56,096 acres	0.30 per cent
Other State	93,816 acres	0.50 per cent
		10.08 percent

Private Ownership of Forest Land

Farm Woodland	9,093,377 acres	48.37 per cent
Industrial	1,543,911 acres	8.22 per cent
Other	6,266,153 acres	33.33 per cent
		89.92 per cent

Timber Stand

Estimated saw timber stand 1938*		43,606,600 M. bd. ft.
Estimated saw timber stand 1945		41,121,000 M. bd. ft.
Estimated under-saw timber stand 1938*		78,464,000 cords
Estimated under-saw timber stand 1945		87,263,000 cords
Total volume in standard cords of all sound wood,	1938*	256,962,400 cords
(excluding chestnut)	1945	257,863,000 cords

*Figures from U. S. Forest Survey

SUMMARY

The Forest Resource Appraisal of North Carolina was undertaken in 1945 as a cooperative project between the American Forestry Association, the Division of Forestry and Parks of N. C. Department of Conservation and Development, and the Division of Forestry of N. C. State College. The North Carolina Appraisal is part of a nation-wide survey conducted by the Association to determine the effects of the war period upon the nation's forests. In many states, more detailed information was desired by the local cooperating agencies than was deemed necessary for the national report. This was the situation in North Carolina. A time limit of one year was imposed for purposes of obtaining the field data and writing the report.

As North Carolina is divided into 100 counties it was necessary to conduct the survey by sample counties. Twenty-one sample counties were carefully chosen from the various topographic units; five were selected in the North Coastal Plain, six in the South Coastal Plain, five in the Piedmont, and five in the Mountain region. Forest area and timber volumes of each county were determined from aerial photographs after a thorough study of ground conditions was completed. All volume estimates are net, defective material having been deducted at the time of making ground measurements. Defect is estimated to run 5 to 8 per cent of gross volume for pine, and 25 per cent of gross volume for hardwood. Volume tables for under-sawlog-size were developed from existing Forest Survey tables and the International ¼ Inch Rule was used for all sawtimber.

New forest acreage figures were determined for all counties because of inaccuracies in previous county areas as given by the U. S. Census. The county and State gross acreage figures were corrected by the U. S. Census in 1940, but no new forest acreage figures had been estimated. New acreage figures were also determined for non-forest, cultivated, idle, pasture, highway, and other land. Ownership of forest land was divided and listed by counties under the headings; Public forest reserve, commercial forest area, National Forest, farm woodland, and other.

Sawtimber volumes for the State were developed from the sample counties. The present volume of 41 billion board feet is 6 per cent lower than reported by the Forest Survey in 1938. Pine sawtimber has a volume of 25 billion board feet, hardwood 16 billion. Average sawtimber stands per average forested acre are low. The state average for all sawtimber being 2.2 thousand board feet per acre, 61 per cent of which is pine and 39 per cent hardwood.

Under-sawlog-size trees have gained approximately 12 per cent in volume since 1938. The average stand per acre for pine and hardwoods combined is 4.71 cords, 53 per cent of which is pine and 47 per cent is hardwood.

U. S. Forest Survey figures show that for the 7 year period from 1937 through 1943 the net annual growth for all material 5.0" d.b.h. and larger, was 9,310 thousand cords while the annual drain was 8,552 thousand cords. Pine has been over-cut as shown by an annual growth of 5,636 thousand cords against an annual drain of 5,847 thousand cords. Hardwood growth has definitely gained during this period with an annual growth of 3,674 thousand cords and drain of 2,705 thousand cords.

Field data show that North Carolina's forest area is 49.9 per cent stocked with sawtimber and under-sawlog-size material, 28.3 per cent stocked with reproduction, and 21.8 per cent or* 4 million acres is non-stocked with timber producing tree species. The greatest single cause of non-stocking is the obstruction by culls and worthless hardwood brush.

Lumber production has been fairly constant since 1889. The average annual cut in North Carolina for the past 56 years has been 1.3 billion board feet.

Pulpwood production has been steadily rising from 240 thousand cords in 1937 to 547 thousand cords in 1943. This trend is still upward.

Fire is a very serious problem, especially in eastern North Carolina. Appraisal results show that approximately 38 per cent of the forest area of the North Coastal Plain and 47 per cent of the forest area of the South Coastal Plain has been burned over in the five year period preceding 1946. For the same period the Piedmont has had a 7.7 per cent burn, while in the Mountain region the burn was 1.2 per cent.

The problem of regulation of cutting on forest lands was approached and studied, but no definite conclusions were reached except that some provision should be made to prevent the complete removal of pine seed sources and that urgent need does not exist for rules applying to hardwood cutting.

In spite of the unfairness of the present system of classifying land for tax purposes, taxes are not unduly high in many counties, the eastern counties having the fairest assessment on timberlands.

It is believed that the State of North Carolina should own and operate State Forests for timber production and demonstration. These forests should be located chiefly in the Piedmont and Coastal Plain; to a lesser extent in the mountains due to existing large Federal ownership.

Forestry education work has been steadily progressing since the appointment of J. S. Holmes as State Forester in 1909. This phase of forestry is, however, far from being adequate. Of the 1,600 million board of feet of lumber cut in 1943 from 17 million acres of forest land, 300 million feet or less was cut under the influence of educational work.

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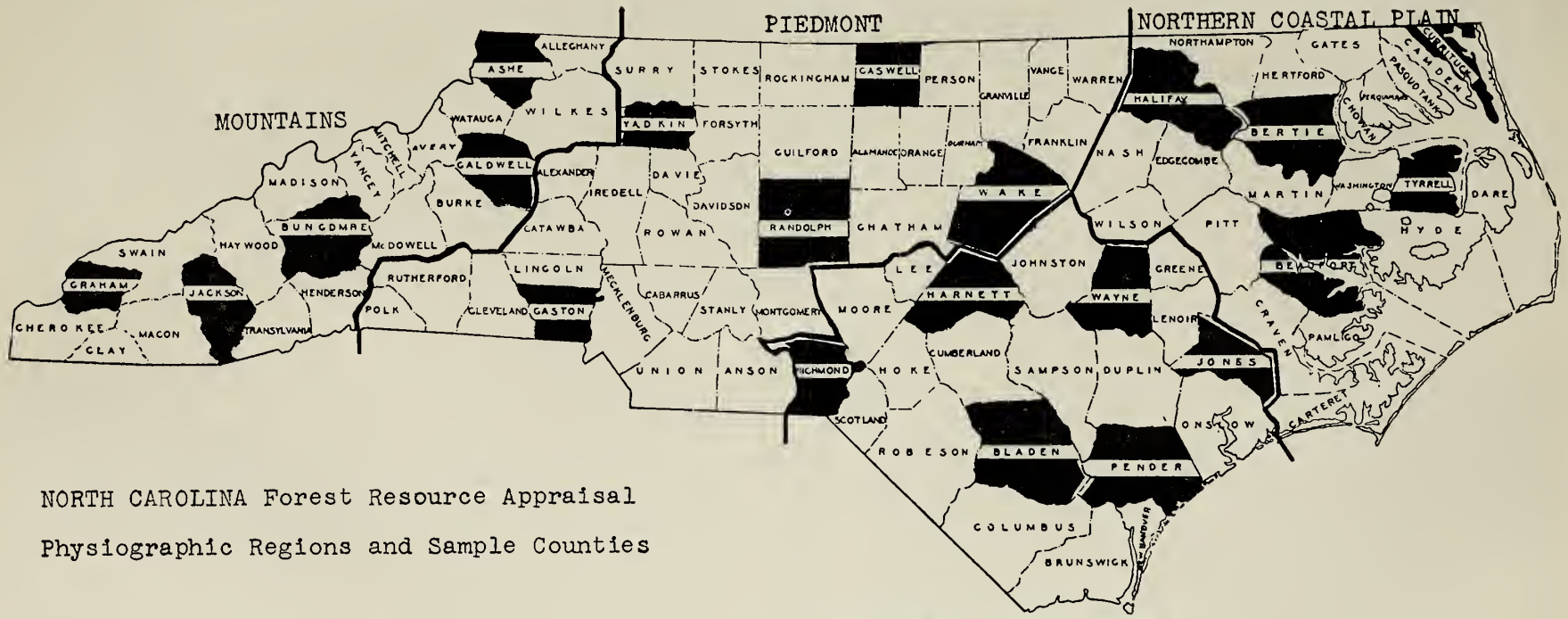
* In accordance with the "Conservative Estimates of Acres Plantable by States" by Philip C. Wakeley, Silviculturist, Southern Forest Experiment Station, exclusive of the Mountain unit, there are 892,300 acres in North Carolina. The Mountain unit shows 120,700 acres of abandoned cropland which in all probability would have to be reforested artificially. This would give a total of 1,013,000 acres which should be planted to forest trees in North Carolina.



NORTH CAROLINA Forest Resource Appraisal

Physiographic Regions and Sample Counties

PHYSICAL FEATURES OF THE STATE

North Carolina has three distinct physiographic regions, namely: the Coastal Plain, the Piedmont Plateau, and the Mountains. Forest conditions vary widely from region to region, therefore, much of the information presented in this report is given separately for each one. Because the Coastal Plain contains approximately one-half of the forest land in the state, and as it is desired to focus attention on important sectional differences, this report further divides the Coastal Plain into a northern half and a southern half. Figure 1 shows the manner in which the state is divided into region or units, and the counties contained in each unit.

The four divisions listed above are the same as those followed by the U. S. Forest Survey of 1937 and 1938, to which frequent references will be made. The former survey obtained certain basic information which this survey did not attempt to duplicate.

As its name implies, the Coastal Plain is a low plain, extending about 15 miles inland. The eastern portion is the Flatwoods or Tidewater area; low and flat, intersected by large sounds and broad rivers which are at sea level. Poor drainage results in numerous swampy areas of variable size.

The western half of this plain progressively rises in elevation and is consequently better drained. Here, the swampy areas are narrowed to lowland bottoms through which slow-moving creeks make their way.

Topography, soils, and moisture largely determine the forest types, or characteristic associations of trees. *Loblolly pine-hardwoods* is the most common forest type in the Coastal Plain. This pine, mixed with gum and other hardwoods, is found almost everywhere except in the more swampy places. *Pond pine-hardwoods* characteristically occupy upland poorly drained areas, some variations of which are known as pocosins and bays. *Bottomland hardwoods* grow thickly along the flooded lowlands of rivers and streams. Two out of five of the sound trees in the Coastal Plain, however, are loblolly pine. About one sound tree in five is a gum—black and tupelo gums being more numerous than red gum. Oaks come next, then pond pine. Various other hardwoods and pine make up the rest.

The Piedmont Plateau lies in the middle of the state and occupies one-third of its area. An upland section of endless small valleys and rolling hills, it is well drained throughout, and thickly populated by small farms.

The *loblolly pine-hardwood* type is prevalent in the eastern portion of the Piedmont region, but gradually plays out in the second tier of Piedmont counties. *Shortleaf pine-hardwoods* occupy nearly one half of this unit. Here the hardwood group is dominated by oaks, gums decreasing in number as the wet lands of the Coastal Plain are left behind. Pines account for most of the board foot and cordwood volumes, one tree out of three being a shortleaf pine. Virginia pine becomes the most abundant pine in the north and west sections of the Piedmont. The *Virginia pine-hardwoods* type extends as the dominant forest cover into the eastern part of the Mountain region.

The Mountain region in the extreme western end of the state is small by comparison with the other two units although it has a forest area greater than the entire state of Connecticut. The Blue Ridge and Smoky Mountains are the principal mountain ranges, but there are numerous irregular cross ranges. The region as a whole is over two-thirds forested, the percentage of woodland exceeding that of the other regions.

Pine-hardwood types make up the bulk of the mountain forests, although in addition to Virginia pine mixed with hardwoods there are also shortleaf pine and white pine mixtures. Oaks comprise more than half of the hardwood sawtimber volume, while shortleaf pine makes up nearly half of the total pine volume in the Mountains. Yellow poplar, a very desirable hardwood, and hickory, the least wanted hardwood, occur more frequently in the Mountains and Piedmont than in the Coastal Plain.

For the state, as a whole, about 50 per cent of the sawtimber volume is loblolly and shortleaf pines, with other pine making up an additional 15 per cent. Gums and oaks in nearly equal proportions, account for about 25 per cent. Poplar, hickory, and cypress lead among the remaining species. When total cordwood volume of all sound trees over five inches d. b. h. (Diameter Breast Height) is considered, the proportion of pine drops to about 50 per cent while the proportion of hard woods comes up to about 50 per cent. Under-sawlog-size material is dominated by hardwoods.

Explanation of Appraisal Methods

The appraisal work was divided into two parts, first, the physical survey of forest stands and conditions in 21 sample counties; and, second, personal and written questionnaire contact with various organizations and individuals.

The physical survey undertook to determine forest area, volume, stocking, reproduction, incidence of fire, cutting methods and forest conditions in each of the sample counties.

The personal and written questionnaire contact work was undertaken to sample public and private attitudes concerning forest management, fire protection, education, tax situations and similar matters, not only in the sample counties, but in other counties as well.

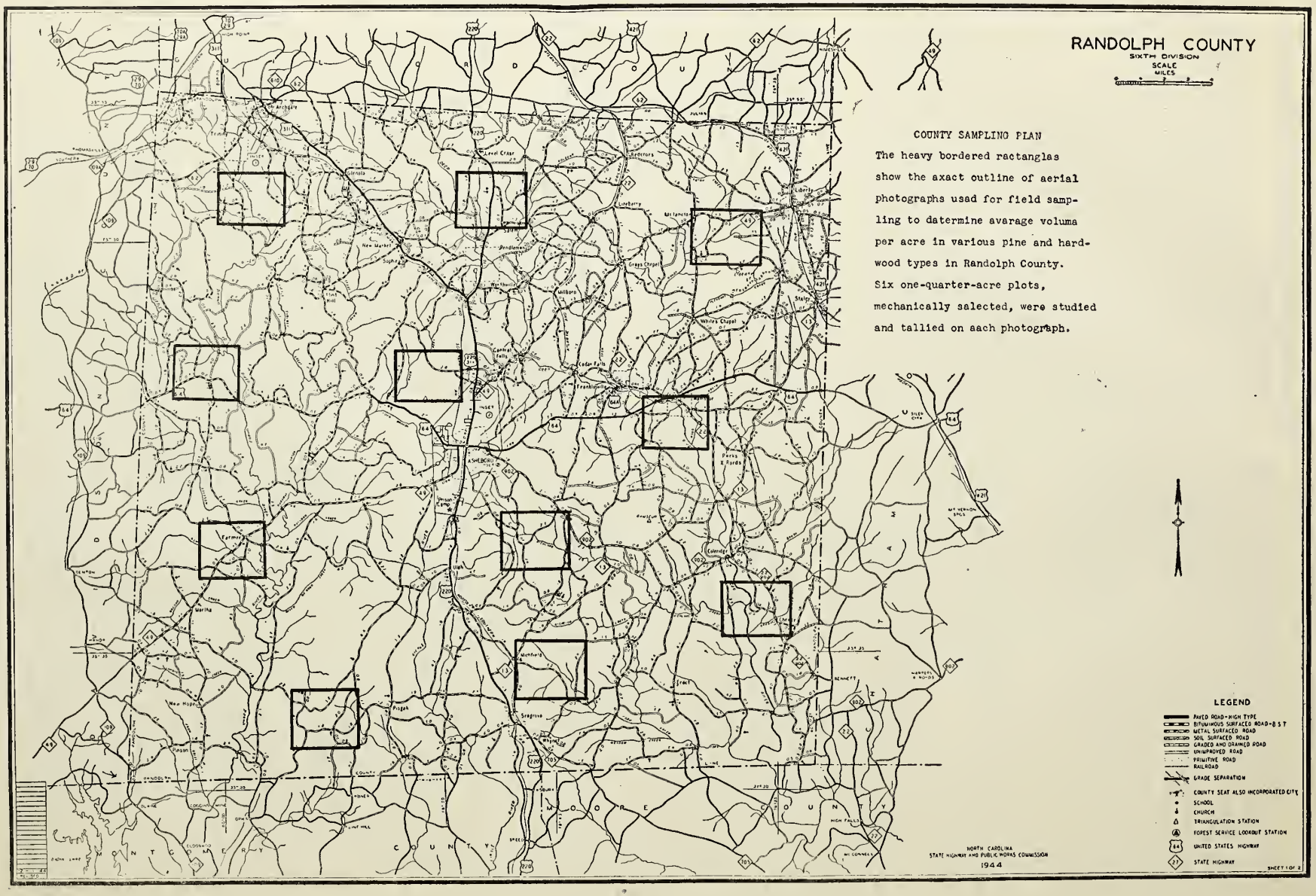
The county sampling plan. Twenty-one sample counties were chosen as representing the conditions most generally found in North Carolina. They were located as follows: Five in the Northern Coastal Plain, six in the Southern Coastal Plain, five in the Piedmont, and five in the Mountain section of the state. The method of survey for one of the sample counties is described below.

New 1944 State Highway maps for each sample county were used as a base upon which the physical survey of each county was planned..

Method of obtaining forest area. Forest area was determined, for each of the sample counties, from aerial photographs. Photographs owned by the Soil Conservation Service, or by the Agricultural Adjustment Administration of the USDA, were used for this purpose.

The photographs were selected so as to eliminate overlapping and give complete coverage for each county. A linear grid with openings comparable to one-acre sample plots at 8-chain intervals was placed on the center of each photograph. The strips were located so as to intersect topography for each county.

Determination of forest area was not attempted until after the completion of the field work, since it was necessary to become familiar with conditions on the ground befor interpreting the photographs. Plots were classified as


RANDOLPH COUNTY
SIXTH DIVISION
SCALE
MILES
COUNTY SAMPLING PLAN
The heavy bordered rectanglas show the exact outline of aerial photographs usad for field sampling to datermine avarage voluma per acre in various pine and hardwood types in Randolph County. Six one-quarter-acre plots, mechanically salected, were studied and tallied on aach photograph.
LEGEND
PAVED ROAD-HIGH TYPE
BITUMINOUS SURFACED ROAD-B S T
METAL SURFACED ROAD
SOIL SURFACED ROAD
GRADED AND DRAINED ROAD
UNIMPROVED ROAD
PRIMITIVE ROAD
RAILROAD
GRADE SEPARATION
COUNTY SEAT ALSO INCORPORATED CITY
SCHOOL
CHURCH
TRIANGULATION STATION
FOREST SERVICE LOOKOUT STATION
UNITED STATES HIGHWAY
STATE HIGHWAY
NORTH CAROLINA
STATE HIGHWAY AND PUBLIC WORKS COMMISSION
1944
SHEET 1 OF 2

forest or non-forest, great care being exercised to assign house lots, rivers, highways, power lines, residential areas, and fields to the non-forest category. Approximately 1200 plots were read from the photographs for each county. Forest acreage was then determined on a percentage basis from the total land area of the county. It is believed that forest area figures, as determined by the above method, are more accurate than other existing figures for the same counties, although time did not permit the making of new forest determinations for all counties having aerial photographs.

Method of Obtaining Timber Volume. When interpreting the aerial photographs for forest acreage, all forest plots were classified according to condition class, in order to improve the accuracy of stand data derived from comparatively few field plots. Condition classes segregated the more or less similar forest stands, but were not standardized for the state. Examination of the photographs would show what conditions could be reliably distinguished. One set of condition classes, good for summer and fall photography, was as follows: 1. Large trees—good density; 2. Large trees—poor density; 3. Advanced reproduction or sapling stands showing no individual tree crowns; 4. Reproduction. Field plots were also separated by condition classes. Average volumes and other forest data were first compiled for each condition class; county totals were then obtained through properly weighing each class by its percentage of total forest area.

Ten to fourteen aerial photographs were selected for each sample county, the photographs being selected so as to grid the county on an equally distributed pattern and given representative coverage conditions found in the sample county. These photographs were then accurately located on the county highway map. (Figure 2). At least six quarter-acre sample plots were mechanically located at speedometer intervals of one-half mile on each photograph. Plot location was at five, ten or twenty-chain intervals from the road. Plots were exactly located on the photograph which was frequently carried to each plot. A check could thus be kept on condition class as found on the ground, as compared with office reading of the photograph. Condition class, volumes, stocking, reproduction, fire occurrence, and other data were recorded while on the plot.

Volume was determined for sawlog size and under-sawlog-size material. Sawlog material may be defined as a tree 9.0", or larger, d.b.h (Diameter Breast Height, i.e. 4½ feet from average ground level) for pine, 13.0" or larger d.b.h. for hardwood. The tree must be 50 per cent sound or contain one sound 12' butt log. The merchantable sawlog top is 5.5". The volume is expressed in board feet. In some cases sawlogs are being cut from pines under 9" and from hardwoods under 13", but it is not felt that the standard should be lowered.

Under-sawlog-size material is 5.0" to 8.9" d.b.h., and a 4.0" top for pine, 5.0 to 12.9" d.b.h. and 4.0" top for hardwood. The tree must be 75 per cent sound and reasonably straight. The volume is expressed in standard cords.

North Carolina has more than its share of cull trees—trees of sawlog or under-sawlog size which fail to meet specifications for those classes. Unfortunately, industries are not making use of them, so there is little demand for information as to their volumes, location, and other features. There was not time, considering their minor importance, to sound out cull trees and determine accurately the sound wood in them. The better culls, that is, those considered to have enough usable wood to justify the cost of cutting, were counted, and these were designated as "usable" culls.

The following information was also recorded for each plot; the number and size of poles, reproduction, stocking, burning in five years, cutting and product cut in five years, and any other pertinent facts.

Volume Tables. The International ¼ Inch Rule was used for sawtimber. Form class volume tables were employed to account for variation in lumber yields caused by tree taper.

All volume estimates are net, defective material having been deducted at the time of making ground measurements. Defect is estimated to run about 5 to 8 per cent of gross volume for pine, and 25 per cent of gross volume for hardwood.

To make a more reliable comparison with Forest Survey estimates, and thereby show trends in timber supplies, volume tables for under-sawlog-size were developed from existing Forest Survey tables. These tables are given as follows:

ESTIMATED VOLUME IN UNDER-SAWLOG-SIZE TREES

	PINE		HARDWOOD	
	d.b.h. inches	No. cords	d.b.h. inches	No. cords
North Coastal Plain and South Coastal Plain	6"	.04	6"	.04
	8"	.09	8"	.09
			10"	.149
			12"	.225
Piedmont	6"	.037	6"	.036
	8"	.089	8"	.087
			10"	.149
			12"	.226
Mountains	6"	.038	6"	.036
	8"	.089	8"	.070
			10"	.099
			12"	.203

LAND USE IN NORTH CAROLINA

County Statistics: total land, forest, and non-forest area. The information assembled in Table 1 appears to be as reliable as any available at present. Total land areas for counties are from careful re-measurements made by the 1940 U. S. Census. They differ considerably, in some cases, from total county areas listed by the Census in previous decades, but are assumed to be correct as aerial photography has provided an improved basis for accuracy.

The acreages of land in each county devoted to forest and non-forest purposes are not accurately known. As indicated by foot notes, forest acreage figures were obtained from three sources and it is believed the great majority will be within 10 per cent of the correct acreage. The sample counties in which land use determinations were made from aerial photographs, are believed to be accurate, although slight changes will have occurred since the time the aerial photographs were made. Generally speaking,

land use is not static. Exact determinations must await new aerial photography, as most counties now have photographs dating back to 1938.

Forest areas do not include "built up" residential areas outside of town limits since these sections are unlikely to be cut over by a commercial operation.

WILL FOREST ACREAGE INCREASE OR DECREASE?

Except in mountainous and swampy areas, much of North Carolina's present forest acreage was at one time cleared for agriculture. The cycle of woods clearing and field abandonment is slowing as agricultural leaders urge

Table 1a.
NORTH COASTAL PLAIN
COUNTY STATISTICS: TOTAL LAND, FOREST, AND NON-FOREST AREA

County	Gross Area	Water Area	Land Area	Non-forest Area	Forest Area	% Forest Area
Beaufort	612,480	80,640	531,840	168,061	363,779	68.4
Bertie	461,440	17,920	443,520	136,604	306,916	69.2
Camden	197,120	44,160	152,960	60,572	92,388	60.4
Carteret	680,320	339,840	340,480	87,163	253,317	74.4
Chowan	149,760	34,560	115,200	67,968	47,232	41.0
Craven	502,400	38,400	464,000	103,472	360,528	77.7
Currituck	300,160	125,440	174,720	94,968	80,022	45.8
Dare	797,440	549,120	248,320	77,228	171,092	68.9
Edgecombe	327,040		327,040	190,332	136,708	41.8
Gates	223,360	3,840	219,520	57,953	161,567	73.6
Halifax	463,360	1,280	462,080	222,723	239,357	51.8
Hertford	231,040	3,200	227,840	82,706	145,134	63.7
Hyde	872,960	467,200	405,760	102,657	303,108	74.7
Martin	308,480	640	307,840	116,671	191,169	62.1
Nash	353,280		353,280	121,456	148,024	41.9
Northampton	348,160	2,560	345,600	171,418	174,182	50.4
Pamlico	368,640	150,400	218,240	72,237	146,003	66.9
Pasquotank	185,600	39,040	146,560	80,022	66,538	45.4
Perquimans	207,360	40,320	167,040	70,658	96,382	57.7
Pitt	419,840		419,840	225,874	193,966	46.2
Tyrrell	373,120	117,760	255,360	41,879	213,481	83.2
Washington	268,800	53,760	215,040	58,276	156,764	72.9
Wilson	238,720		238,720	145,620	93,100	39.0
Regional Totals	8,890,880	2,110,080	6,780,800	2,640,048	4,140,752	61.1

Table 1b.
SOUTH COASTAL PLAIN
COUNTY STATISTICS: TOTAL LAND, FOREST, AND NON-FOREST AREA

County	Gross Area	Water Area	Land Area	Non-forest Area	Forest Area	% Forest Area
Bladen	570,240	7,680	562,560	137,265	425,295	75.4
Brunswick	580,480	21,760	558,720	86,602	472,118	84.5
Columbus	610,560	9,600	600,960	129,206	471,754	78.5
Cumberland	423,680	640	423,040	142,565	280,475	66.3
Duplin	526,720	640	526,080	178,341	347,739	66.1
Greene	172,160		172,160	98,820	73,340	42.6
Harnett	388,480	640	387,840	149,706	238,134	61.4
Hoke	265,600	640	264,960	87,437	177,523	67.0
Johnston	508,800		508,800	275,770	233,030	45.8
Jones	299,520	640	298,880	66,949	231,931	77.6
Lee	163,840	640	163,200	61,363	101,837	62.4
Lenoir	250,240		250,240	121,116	129,124	51.6
Moore	430,720	640	430,080	108,810	321,270	74.7
New Hanover	144,000	19,840	124,160	33,027	91,133	73.4
Onslow	515,840	32,000	483,840	110,799	373,041	77.1
Pender	556,160	7,680	548,480	83,369	465,111	84.8
Richmond	309,120	3,840	305,280	123,869	191,411	62.7
Robeson	606,720	2,560	604,160	277,309	327,455	54.2
Sampson	616,320		616,320	248,377	367,943	59.7
Scotland	202,880		202,880	90,079	112,801	55.6
Wayne	355,200		355,200	179,376	175,824	49.5
Regional Totals	8,497,280	109,440	8,387,840	2,780,155	5,607,685	66.9

that farming "settle down" on the good lands and keep them fertile through conservation practices. This will take a long time. Patches of woods continue to be cleared for pasture or tobacco, while fields are abandoned to be occupied by pine, oak, or gum trees.

At present 60 per cent of North Carolina is forested. Will this percentage increase, or will agricultural expansion result in widespread clearing?

From a sifting of opinions collected in 23 counties, and drawing upon personal observations, it appears that the trend for the past 10 years has been in favor of the woodland.

Soil Conservation Service experts suggest that over 2,500,000 acres of the farm forest land in the Coastal Plain and Piedmont should be cleared, with 500,000 acres of poor open land to revert to timber use.

The comment might be made that agricultural experts in the South have, for decades, pointed to all the good land that could be cleared and farmed, but their proposals seem to have fallen on unheeding ears. Big lumber companies in the deep South figured they were preparing the way for farms, but their farm promotion schemes did not produce the desired results. Cropland has been declining in the South for 40 years, woods acreage has been increasing. Factors other than availability of land have been more decisive.

Discussion of findings by the four units follows:

Northern and Southern Coastal Plain. The Northern Coastal Plain is 61 per cent forested, ranging from 31 per cent in Wilson to 83 per cent in Tyrrell. The Southern Coastal Plain is 67 per cent forested, ranging from 45 per cent in Greene to 85 per cent in Pender.

The old cycle of clearing "new ground" and allowing "worn out" fields to grow up in trees is still in evidence. Yet tidewater counties show the least change of any part of the state, as clearing must usually be accompanied by drainage. Change continues actively in middle and western Coastal Plain counties.

Eleven counties were sampled in these two units. Six of these—Halifax, Bertie, Beaufort, Jones, Pender, and

Table 1c.
PIEDMONT
COUNTY STATISTICS: TOTAL LAND, FOREST, AND NON-FOREST AREA

County	Gross Area	Water Area	Land Area	Non-forest Area	Forest Area	% Forest Area
Alamance	277,760		277,760	153,324	124,436	44.8
Alexander	165,760	2,560	163,200	84,084	79,152	48.5
Anson	343,040	1,920	341,120	156,915	184,205	54.0
Cabarrus	230,400		230,400	144,230	86,170	37.4
Caswell	278,400		278,400	125,558	152,842[1]	54.9
Catawba	263,680	3,840	259,840	153,306	106,534	41.0
Chatham	452,480		452,480	173,752	278,728	61.6
Cleveland	298,240		298,240	198,926	99,314	33.3
Davidson	358,400	7,680	350,720	188,687	162,033	46.2
Davie	168,960		168,960	115,400	53,560	31.7
Durham	192,000	640	191,360	72,525	118,835	62.1
Franklin	316,160		316,160	168,512	147,648	46.7
Forsyth	271,360		271,360	173,670	97,690	36.0
Gaston	232,320	3,200	229,120	143,887	85,233[1]	37.2
Granville	347,520		347,520	145,263	202,257	58.2
Guilford	417,280	640	416,640	236,235	180,405	43.3
Iredell	380,160	1,920	378,240	242,830	135,410	35.8
Lincoln	197,760	640	197,120	131,479	65,641	33.3
Mecklenburg	351,360	4,480	346,880	196,334	150,546	43.4
Montgomery	319,360	7,040	312,320	91,197	221,123	70.8
Orange	254,720		254,720	102,397	152,323	59.8
Person	256,000		256,000	112,640	143,360	56.0
Polk	150,400	640	149,760	64,097	85,663	57.2
Randolph	512,640		512,640	209,157	303,483[1]	59.2
Rockingham	366,080		366,080	199,880	166,200	45.4
Rowan	337,280	6,400	330,880	244,190	86,690	26.2
Rutherford	363,520	1,280	362,240	180,396	181,844	50.2
Stanly	259,840	4,480	255,360	134,830	120,530	47.2
Stokes	293,760		293,760	149,230	144,530	49.2
Surry	344,320	640	343,680	164,623	179,057	52.1
Union	411,520		411,520	284,772	126,748	30.8
Vance	172,160		172,160	103,640	68,520	39.8
Wake	554,880	640	554,240	244,420	309,820[1]	55.9
Warren	284,800		284,800	129,300	155,500	54.6
Yadkin	214,400		214,400	120,278	94,122[1]	43.9
Regional Totals	10,638,720	48,640	10,590,080	5,539,928	5,050,152	47.7

Bladen were reported by Soil Conservation personnel to have a balanced situation with regard to new woods and new fields. It was found that Currituck, Tyrrell, and Richmond might have a slight trend toward increase of woodland area. In Wayne and Harnett, clearing of woods seems to exceed the rate of field abandonment. There is general agreement that clearing of woodland is most active in the heavy tobacco producing counties. About 15 Middle and Western Coastal Plains counties are heavy tobacco producers. At present, it can be said that land clearing and land abandonment seem to be very nearly balanced in the region as a whole.

Experts of the Soil Conservation Service say that about ⅓ of the forest land in the Coastal Plain is equal or superior to areas now in cultivation, and they recommend considerable clearing of woods on farms, whereas other farm experts maintain such clearing would be unwise, due to the need for fuel and timber on the farms.

Piedmont. This unit is 48 per cent forested, ranging from 26 per cent in Rowan to 71 per cent in Montgomery.

Clearing of woods for agriculture is active. The northern counties are heavy producers of tobacco, and periodic recruitment of "new ground" for this crop has always been considered a paying practice in the red hills. Pasture clearing for a growing cattle industry has also been responsible for a decrease of forest acreage in some counties.

However, erosion has been serious. This, combined with continued loss of cotton markets, has caused widespread abandonment of fields. In only one of seven Piedmont counties, where the matter was investigated, did agricultural leaders claim that open land was increasing at the expense of woodlands. This was Wake County, but even here a 10-year trend might show that the woodland is increasing. No opinion could be formed in Gaston, but Randolph, Caswell, Yadkin, and Rowan show a gradual increase in woodland area.

Soil Conservation technicians agreed that the fields being abandoned to forest represented a desirable trend because of poor land, small patches, and steep slope. At the same time, the S. C. S. says that ⅓ of the Piedmont forest area might well be cleared for crops and pasture as these forest areas are superior to lands in cultivation at the present time.

Mountains. This 21-county unit is 70 per cent forested, ranging from 33 per cent in Ashe to 92 per cent in Graham.

Opinion and observation point to the probability that woodland area is gradually gaining. This was said to be the case in Buncombe, Jackson, and Graham, where agricultural technicians considered the trend desireable because land had been cleared for corn and many farms on ridgeland never were suitable for farming. Stability was said to have been reached in Ashe, where farmers have cleared about all they can for pasture, perhaps overdoing it on extremely steep slopes. Woodland area was said to be decreasing in Caldwell, due to industrial workers spreading out on new small farms. The Forest Survey in 1938 found abandoned cropland nearly five times as extensive as the new cropland.

While advocating considerable clearing in the Coastal Plain and Piedmont, Soil Conservation Service soil capability surveys would not reduce aggregate woodland area

Table 1d
MOUNTAINS
COUNTY STATISTICS: TOTAL LAND, FOREST, AND NON-FOREST AREA

County	Gross Area	Water Area	Land Area	Non-forest Area	Forest Area	% Forest Area
Alleghany	147,200		147,200	95,386	51,814	35.2
Ashe	273,280		273,280	182,004	91,276[1]	33.4
Avery	158,080		158,080	54,854	103,226	65.3
Buncombe	414,080	640	413,440	140,156	273,284	66.1
Burke	330,880	7,040	323,840	83,551	240,289	74.2
Caldwell	307,200	2,560	304,640	84,081	220,559[1]	72.4
Cherokee	298,880		298,880	62,880	236,000[2]	79.0
Clay	140,160		140,160	28,593	111,567	79.6
Graham	191,360	2,560	188,800	15,900	172,900[2]	91.6
Haywood	348,160	640	347,520	97,220	250,300[1]	72.0
Henderson	244,480		244,480	99,014	145,466	59.5
Jackson	319,360		319,360	66,108	253,252	79.3
McDowell	286,080	3,200	282,880	55,727	227,153	80.3
Macon	332,800		332,800	63,565	269,235	80.9
Madison	291,840		291,840	117,040	174,800[2]	60.0
Mitchell	140,800		140,800	49,400	91,400[2]	64.9
Swain	348,160		348,160	37,360	310,800[2]	89.3
Transylvania	242,560		242,560	35,656	206,904	85.3
Watauga	204,800		204,800	104,448	100,352	49.0
Wilkes	489,600		489,600	161,521	322,157	65.8
Yancey	199,040		199,040	59,040	140,000[2]	70.3
Regional Totals	5,708,800	16,640	5,692,160	1,693,504	3,998,656	70.2

1. Sample counties in which new forest area figures were developed by interpretation of aerial photographs. (N. C. Forest Resource Appraisal).
2. Tennessee Valley Authority determinations of forest area based on planimetric maps.
3. All others are Forest Survey forest acreage figures corrected to the 1940 Census on a percentage basis. Original figures were obtained from Forest Survey Release No. 19. "Approximate Area and Timber Volumes by Counties in the Carolinas and Virginia."

Table 2a
COUNTY STATISTICS: LAND USE OF NON-FOREST AREA
(ACRES)
NORTH COASTAL PLAIN

County	Non-Forest Area	Cultivated	Idle	Pasture	Highway	Other
Beaufort	168,061	98,327	8,737	3,437	3,981	53,579
Bertie	136,604	88,611	2,852	2,330	2,751	40,060
Camden	60,572	35,140	1,692	1,366	989	21,385
Carteret	87,163	15,286	2,154	677	1,549	67,497
Chowan	67,968	35,653	680	1,356	1,042	29,237
Craven	103,472	59,503	7,689	2,788	3,049	30,443
Currituck	94,698	32,159	3,796	2,150	1,131	55,462
Dare	77,228	429	72	72	1,100	75,555
Edgecombe	190,332	130,900	9,622	5,210	3,329	41,271
Gates	57,953	40,397	4,140	1,980	1,751	9,685
Halifax	222,723	154,597	12,501	8,541	3,717	43,367
Hertford	82,706	53,972	3,770	1,198	1,945	21,821
Hyde	102,657	34,125	2,770	3,067	1,258	61,437
Martin	116,671	78,058	1,792	2,907	2,518	31,396
Nash	205,256	136,312	7,712	4,110	4,276	52,846
Northampton	171,418	121,297	8,063	4,504	2,585	34,969
Pamlico	72,237	30,613	5,374	1,172	1,249	33,829
Pasquotank	80,022	45,477	1,652	3,558	1,177	28,158
Perquimans	70,658	46,479	1,226	1,672	1,263	20,018
Pitt	225,874	155,317	4,345	5,047	4,861	56,304
Tyrrell	41,879	17,384	1,053	732	952	21,758
Washington	58,276	28,289	3,770	2,675	1,119	22,423
Wilson	145,620	106,455	3,085	3,297	3,095	29,688
Regional Totals	3,240,048	1,544,780	98,547	63,846	50,687	882,188

Table 2b
COUNTY STATISTICS: LAND USE OF NON-FOREST AREA
(ACRES)
SOUTH COASTAL PLAIN

County	Non-Forest Area	Cultivated	Idle	Pasture	Highway	Other
Bladen	137,265	70,738	10,211	4,483	3,741	48,092
Brunswick	86,602	35,056	6,265	1,193	2,799	41,289
Columbus	129,206	108,218	7,199	4,609	4,908	4,272
Cumberland	**142,565**	**91,301**	**11,440**	4,985	3,572	31,267
Duplin	178,341	135,292	12,562	8,299	5,147	17,041
Greene	98,820	77,846	2,134	2,424	2,113	14,303
Harnett	149,706	116,025	7,166	2,774	3,932	19,809
Hoke	87,437	61,662	7,576	1,949	1,930	14,320
Johnston	275,770	199,939	11,267	7,226	5,966	51,372
Jones	66,949	46,233	5,877	2,644	1,419	10,776
Lee	61,363	33,646	9,791	4,667	1,824	11,435
Lenoir	121,116	102,649	5,658	3,335	3,344	6,130
Moore	108,810	53,914	14,467	5,988	3,531	30,910
New Hanover	33,027	8,359	3,253	623	996	19,796
Onslow	110,799	47,550	9,339	2,233	2,571	49,106
Pender	83,369	39,237	14,664	2,432	2,888	24,148
Richmond	123,869	55,584	25,310	6,745	3,197	33,033
Robeson	277,309	224,158	12,164	7,556	6,718	26,713
Sampson	248,377	169,907	8,569	4,335	6,022	59,544
Scotland	90,079	67,872	8,408	1,503	2,195	10,101
Wayne	179,376	146,946	11,087	7,702	4,311	9,330
Regional Totals	2,790,155	1,892,132	204,407	87,705	73,124	532,787

in the Mountains. In view of the long active gain of new woods over new clearing, and the steady purchase of land for public forests, it is highly probable that the Mountains will have additional forest acreage in the future.

COUNTY STATISTICS: UTILIZATION OF NON-FOREST LAND

Table 2 contains estimates of the various non-forest uses of land. The agricultural land information was available from three main sources: the N. C. Crop Reporting Service (N. C. Department of Agriculture), the Agricultural Adjustment Administration (USDA), and the 1940 Census. The first two are conceded to be more reliable than the third for this particular information, and they offer more recent data.

N. C. Crop Reporting Service figures for 1944 are presented here because they include estimates of idle land, which AAA does not.

COUNTY STATISTICS: OWNERSHIP OF FOREST LAND

County Table 3 and state summary Table 4 illustrate the breakdown of forest land ownership. Several categories could not be completely analyzed by counties, but their identity is made known in the footnotes. Ownership figures do not remain static as forest lands are always changing hands.

Public forest reserves are represented by National and State Park lands upon which no timber cutting is contemplated. An additional 44,000 acres in Swain County will soon be added to the Great Smoky Mountains National Park.

National Forest ownership is concentrated in the Mountain region. It can be expected that further land purchases will be made. National Forests are already established in the Coastal Plain and Piedmont. Expansion is possible in the coastal section, but doubtful in the Piedmont due to the lack of large unpopulated areas.

Table 2c
COUNTY STATISTICS: LAND USE OF NON-FOREST AREA
(ACRES)
PIEDMONT

County	Non-Forest Area	Cultivated	Idle	Pasture	Highway	Other
Alamance	153,324	85,887	21,801	20,061	3,883	21,692
Alexander	84,084	44,882	10,864	13,456	2,176	12,706
Anson	156,915	92,374	14,350	7,448	3,616	39,127
Cabarrus	144,230	82,669	13,764	12,070	3,210	32,517
Caswell	125,558	68,157	27,444	14,752	2,571	12,634
Catawba	153,306	84,374	18,798	19,019	3,309	27,806
Chatham	173,752	75,700	21,218	19,912	4,159	52,763
Cleveland	198,926	142,620	12,761	16,116	4,681	22,748
Davidson	188,687	97,303	24,637	19,234	5,046	42,466
Davie	115,400	53,424	10,619	14,346	2,041	34,970
Durham	72,525	30,731	11,770	4,667	2,756	22,601
Forsyth	173,670	75,733	24,216	14,008	4,359	55,354
Franklin	168,512	94,732	17,364	7,898	3,301	45,217
Gaston	143,887	64,578	15,205	11,661	3,191	49,252
Granville	145,263	74,560	15,884	14,899	3,275	36,645
Guilford	236,235	109,591	30,795	24,646	6,313	64,887
Iredell	242,830	139,286	23,342	32,290	5,386	42,526
Lincoln	131,479	74,245	11,793	12,702	2,606	30,133
Mecklenberg	196,334	96,536	21,049	24,876	4,511	49,362
Montgomery	91,197	38,235	9,827	3,155	2,600	37,380
Orange	102,397	51,318	15,017	12,718	3,099	20,246
Person	112,640	71,898	8,872	9,910	2,661	19,299
Polk	64,097	24,482	6,171	6,120	1,816	25,508
Randolph	209,157	113,087	38,330	24,001	5,937	27,802
Rockingham	199,880	93,208	19,889	23,824	4,398	58,561
Rowan	244,190	116,177	15,751	17,744	4,273	90,245
Rutherford	180,396	87,134	23,463	16,253	4,328	49,218
Stanly	134,830	93,630	7,938	11,248	3,449	18,565
Stokes	149,230	62,900	19,446	18,443	4,084	44,357
Surry	164,623	83,565	14,515	26,215	3,875	36,453
Union	284,772	154,852	15,538	29,840	5,369	79,173
Vance	103,640	47,969	6,165	4,259	1,668	43,579
Wake	244,420	134,351	26,708	15,248	6,696	61,417
Warren	129,300	71,043	11,833	10,630	2,543	33,251
Yadkin	120,278	72,572	12,093	16,353	2,700	17,560
Regional Totals	5,539,964	2,903,803	599,230	550,022	129,886	1,358,020

Table 2d

COUNTY STATISTICS: LAND USE OF NON-FOREST AREA

(ACRES)

MOUNTAINS

County	Non-Forest Area	Cultivated	Idle	Pasture	Highway	Other
Alleghany	95,386	20,731	3,324	72,986	2,239	*
Ashe	182,004	38,484	8,136	133,042	3,537	*
Avery	54,854	16,886	6,567	24,905	1,493	5,013
Buncombe	140,156	52,941	32,506	64,405	5,646	*
Burke	83,551	31,266	12,070	9,728	3,058	27,429
Caldwell	84,081	34,950	10,296	16,926	2,802	19,017
Cherokee	62,880	21,942	9,609	10,331	2,215	18,783
Clay	28,593	12,395	2,612	9,272	1,004	3,310
Graham	15,900	5,626	2,453	4,326	1,031	2,464
Haywood	97,220	28,728	9,332	70,262	2,415	*
Henderson	99,014	35,419	7,566	21,548	3,020	31,461
Jackson	66,108	19,136	5,383	27,613	2,546	11,430
McDowell	55,727	17,633	5,934	8,317	2,308	21,535
Macon	63,565	24,676	10,438	28,005	2,671	*
Madison	117,040	37,092	15,632	73,623	3,006	*
Mitchell	49,400	22,699	9,715	20,264	1,239	*
Swain	37,360	6,527	3,914	8,383	1,571	16,965
Transylvania	35,656	11,298	4,662	5,770	2,165	11,761
Watauga	104,448	26,694	5,819	66,929	2,365	2,641
Wilkes	161,521	69,165	39,420	44,063	5,623	3,250
Yancey	59,040	27,228	11,132	30,680	1,567	*
Regional Totals	1,693,504	561,516	216,520	751,378	53,521	175,059

* This column reveals small discrepancies in estimates of agricultural land use. We believe this is caused by woodland pasture being counted twice; once as woodland and again as pasture.

Table 3a

COUNTY STATISTICS: FOREST LAND OWNERSHIP

(ACRES)

NORTH COASTAL PLAIN

County	Forest Area (Acres)	Public Forest Reserve	Commercial Forest Area	National Forest	Farm Woodland	Other
Beaufort	363,779		363,779		118,985	244,794
Bertie	306,916		306,916		146,680	160,236
Camden	92,388		92,388		24,698	67,690
Carteret	253,317		253,317	50,531	34,622	168,164
Chowan	47,232		47,232		32,118	15,114
Craven	360,528		360,528	46,367	96,759	217,402
Currituck	80,022		80,022		33,570	46,452
Dare	171,092		171,092		828	170,264
Edgecombe	136,708		136,708		123,179	13,529
Gates	161,567		161,567		62,363	99,204
Halifax	239,357		239,357		149,441	89,916
Hertford	145,134		145,134		86,358	58,776
Hyde	303,103		303,103		23,483	279,620
Martin	191,169		191,169		105,732	85,437
Nash	148,024		148,024		132,111	15,913
Northampton	174,182		174,182		98,385	75,797
Pamlico	146,003		146,003		32,700	113,303
Pasquotank	66,538		66,538		27,558	38,980
Perquimans	96,382		96,382		38,128	58,254
Pitt	193,966		193,966		127,966	65,970
Tyrrell	213,481		213,481		20,720	102,761
Washington	156,764		156,764		24,392	132,372
Wilson	93,100		93,100		88,199	4,901
Regional Totals	4,140,752		4,140,752	96,898	1,629,005	2,414,489

State forests are represented by one area of approximately 40,000 acres in Bladen County. Acquisition of land for state forests is urgently needed. If and when forest lands now operated by the War Department become unnecessary as military establishments, the state should make every effort to acquire these lands for state forests. This is an immediate concern. (Other means of acquiring state forests are discussed in another section.)

Failure to acquire lands for state forests has seriously handicapped the forest conservation movement. Practically all states that have made their names stand out in the field of conservation own state forests or are busily acquiring them. Private owners should be encouraged to keep and develop forest lands where they want to, but in some sections of North Carolina, more public forests are indicated and seem to be locally desired. State forests can be small units and as such will fit the needs that exist today. "Underneath all, the land." Prestige for state conservation is lost if the land goes out of state sovereignty. State forests add stability to conservation work; are proving grounds for techniques; training grounds for personnel who are to assist private owners; useful for demonstrations; strong "anchor points" which help private owners in fire control; and, finally, they will more than pay their way.

Approximately one-half of the commercial forest acreage of North Carolina is classified as farm woodland by the U. S. Census of 1940. These figures, as well as those from other sources, are only approximately correct. The error in acreage may be considerable, due to the methods of classifying farm woodland. For example, according to U. S. Census definitions, if a tract of 1500 acres had three acres of cultivated land and 1497 acres of forest, the forest area would be classified as farm woodland, although this area would not function as a farm woods and would not be managed as such. Regardless of the above classification, the farm forest is one of the State's important assets. The majority of the farmers still do not appreciate the value of their woodlands, but progress is being made in farm forestry, especially since 1943, when the state and federal governments began to put Farm Foresters into the counties to help owners on the ground.

There are approximately one and one-half million acres of forest land industrially owned in North Carolina. This figure was developed from the tax records of each of the 100 counties. There was no way of determining the amount of forest land owned by small sawmill operators, who are not listed as timber companies in the tax records.

With the possible exception of the pulp companies and a few progressive lumber companies, the wood-using industries of North Carolina have not taken advantage of the timber growing possibilities of lands in this state. It has been said that lumber companies keep their "brains" in the office, and do not know much about the woods—other than how much timber there is, and how to get it out. Pulp companies have technically trained men in the woods and know growth possibilities. They have acquired, and are still acquiring, lands on which they intend to practice good forestry measures.

Lumber companies in Alabama, Arkansas, and other Southern States have acquired lands and are making the practice of forestry a paying proposition. The question was asked, "Why have most companies failed to do so in this state, even though some have owned large tracts in

Table 3b

COUNTY STATISTICS: FOREST LAND OWNERSHIP
(ACRES)
SOUTH COASTAL PLAIN

County	Forest Area (Acres)	Public Forest Reserve	Commercial Forest Area	National Forest	Farm Woodland	Other
Bladen	425,295	500[1]	424,795	40,000*	150,635	274,160
Brunswick	472,118		472,118		124,353	347,765
Columbus	471,754		471,754		179,080	292,674
Cumberland	280,475		280,475		111,773	168,702
Duplin	347,739		347,739		166,456	181,283
Greene	73,340		73,340		48,810	24,530
Harnett	238,134		238,134		119,075	119,059
Hoke	177,523		177,523		58,746	118,777
Johnston	233,030		233,030		184,696	48,334
Jones	231,931		231,931	28,989	57,495	145,447
Lee	101,837		101,837		61,621	40,216
Lenoir	129,124		129,124		82,710	46,414
Moore	321,270		321,270		140,516	180,754
New Hanover	91,133		91,133		11,926	79,207
Onslow	373,041		373,041		97,568	275,473
Pender	465,111		465,111		78,412	386,699
Richmond	191,411		191,411		77,259	114,152
Robeson	326,851		326,851		146,966	179,885
Sampson	367,943		367,943		214,475	153,468
Scotland	112,801		112,801		33,619	79,182
Wayne	175,824		175,824		103,516	72,308
Regional Totals	5,607,685	500	5,607,685	28,989	2,249,707	3,288,489

* Bladen Lakes State Forest.

the past and others have had the opportunity to purchase lands in recent years?" Numerous contacts with the larger sawmills brought out the following reasons:

1. Lack of capital.
2. High fire risk.
3. High taxes on forest land.
4. Cheaper to buy stumpage than raise it.
5. Lack of knowledge as to the timber growing possibilities.

A few progressive lumber companies know that if they are to stay in business they must be concerned with the growing of their raw material. One progressive box and lumber company said, "Land purchases are imperative. We have been and are purchasing lands right along."

Naturally, timber concerns located in counties checkerboarded with farms have little oportunity to acquire forests. Probably they will remain small organizations, and their timber requirements can be supplied permanently from the farms. Where farming is on a good permanent basis, farmers can be taught and assisted in timber farming. The majority will eventually learn to do a good job just as they have learned and are applying good practices in tobacco, livestock, and other farming activities.

The most favorable place for acquisition of timber lands by industry in in the big woods sections characterized by scattered or unstable farms and absentee owners. In many cases these woods are not in strong hands. If they have commercial timber growing possibilities, as in the majority of cases, industry can help itself and serve the public interest by acquiring tracts and holding them to grow timber crops. American forestry has made its greatest advances in sections where industry has taken hold and shown the way. North Carolina forestry has suffered because her timbermen have been slow to do this. Many now say they intend to get into the business. Woods areas away from good farms, and lacking the possibilities that would attract industry, would seem to be a field for public ownership. However, any individual who owns such

Table 3c
COUNTY STATISTICS: FOREST LAND OWNERSHIP
(ACRES)
PIEDMONT

County	Forest Area (Acres)	Public Forest Reserve	Commercial Forest Area	National Forest	Farm Woodland	Other
Alamance	124,436		124,436		91,587	32,849
Alexander	79,152		79,152		73,687	5,465
Anson	184,205		184,205		125,526	58,679
Cabarrus	86,170		86,170		63,194	22,976
Caswell	152,842		152,842		113,779	39,063
Catawba	106,534		106,534		81,978	24,556
Chatham	278,728		278,728		182,184	96,544
Cleveland	99,314		99,314		71,827	27,487
Davidson	162,033		162,033	677	94,792	66,564
Davie	53,560		53,560		52,442	1,118
Durham	118,835		118,835		62,277	56,558
Forsyth	97,690		97,690		88,615	9,075
Franklin	147,648		147,648		131,414	16,234
Gaston	85,233		85,233		56,591	28,642
Granville	202,257		202,257		170,127	32,130
Guilford	180,405		180,405		137,551	42,854
Iredell	135,410		135,410		126,057	9,353
Lincoln	65,641		65,641		55,104	10,537
Mecklenburg	150,546		150,546		73,927	76,619
Montgomery	221,123		221,123	27,241	88,450	105,432
Orange	152,323		152,323		91,475	60,848
Person	143,360		143,360		128,521	14,839
Polk	85,663		85,663		46,287	39,376
Randolph	303,483		303,483	8,137	219,521	75,825
Rockingham	166,200		166,200		142,926	23,274
Rowan	86,690		86,690		83,472	3,218
Rutherford	181,844		181,844		111,445	70,399
Stanly	120,530	3,000[1]	117,530		91,443	26,087
Stokes	144,530	3,000[1]	141,530		132,062	9,468
Surry	179,057	910[2]	178,147		142,274	35,873
Union	126,748		126,748		151,676	
Vance	68,520		68,520		83,540	
Wake	309,820	3,500[1]	306,320		203,259	103,061
Warren	155,500		155,500		113,389	42,111
Yadkin	94,122		94,122		77,533	16,589
Regional Totals	5,050,152	10,410	5,039,742	36,055	3,759,932	1,283,703

land, and wishes to keep it, should be helped to practice forestry.

The six million acres of forest land not classified are mainly in private ownership. A large portion of this land is owned by investment type owners such as insurance companies, banks, individuals, estates, and hunting clubs.

THE SUPPLY OF SAWTIMBER

The supply of sawtimber was inventoried during the spring of 1945, in 21 counties, which are believed to represent the general range of conditions throughout North Carolina.

Table 3d
COUNTY STATISTICS: FOREST LAND OWNERSHIP
(ACRES)
MOUNTAINS

County	Forest Area (Acres)	Public Forest Reserve	Commercial Forest Area	National Forest	Farm Woodland	Other
Alleghany	51,814	4,228[2]	47,586		34,946	12,640
Ashe	91,276	1,138[2]	90,138	327	71,287	18,254
Avery	103,226	1,233[2]	101,993	22,134	46,862	32,997
Buncombe	273,284	1,652[2]	271,941	30,941	108,892	131,779
Burke	240,289	243[2]	240,046	46,915	85,993	107,138
Caldwell	220,559		220,559	49,142	109,051	62,366
Cherokee	236,000		236,000	60,022	91,563	84,345
Clay	111,567		111,567	52,073	29,729	29,765
Graham	172,900	3,800[3]	169,100	57,672	27,171	84,257
Haywood	250,300	59,889*	190,411	63,291	53,156	73,964
Henderson	145,466		145,466	18,635	53,212	73,619
Jackson	253,252	528[2]	252,724	18,659	84,238	149,827
McDowell	227,153	885[2]	226,268	58,929	46,077	121,262
Macon	269,235		269,235	144,309	60,447	64,479
Madison	174,800		174,800	46,189	88,630	39,981
Mitchell	91,400	563[2]	90,837	15,122	34,982	40,733
Swain	310,800	168,961*	141,839	5,616	59,647	76,576
Transylvania	206,904		206,904	81,626	35,904	89,374
Watauga	100,352	980[2]	99,372	393	63,870	35,109
Wilkes	328,079	4,699*	323,380		197,229	126,151
Yancey	140,000	1,178*	138,822	31,849	71,757	35,216
Regional Totals	3,998,656	249,977	3,748,679	803,824	1,454,733	1,490,122

[1] N. C. State Parks.
[2] Blue Ridge Parkway.
[3] Joyce Kilmer Memorial Forest. Nantahala National Forest.
* Haywood: includes 59,535 acres in the Great Smoky Mountain National Park and 354 acres in the Blue Ridge Parkway.
* Swain: includes 168,310 acres in Great Smoky Mountain National Park and 651 acres in the Blue Ridge Parkway. Does not include 44,400 acres being acquired for National Park Service.
* Wilkes: includes 100 acres in N. C. State Park and 4,599 acres in Blue Ridge Parkway.
* Yancey: includes 800 acres in N. C. State Park and 378 acres in Blue Ridge Parkway.

Table 4
STATE SUMMARY OF FOREST OWNERSHIP

Region	Gross Forest Area	Public[1] Reserve	Commercial Forest Area	National Forests	Other[2] Federal	Farm Woodland	State[3] Municipal County	Industrial	Other
North Coastal Plain	4,140,752		4,140,752	96,898		1,629,005		869,558	
South Coastal Plain	5,607,685	500	5,607,185	28,989		2,249,707		370,074	
Piedmont	5,050,152	10,410	5,039,742	36,055		3,759,932		95,755	
Mountains	3,998,656	249,977	3,748,679	803,829		1,454,733		208,504	
State Total	18,797,245	260,887	18,536,358	965,766	396,594	9,093,377	270,557	1,543,911	6,266,153

[1] Includes state parks ..... 10,910 acres
[2] Soil Conservation Service ..... 12,276 acres
Farm Security Administration ..... 13,730 acres
Fish and Wildlife Service ..... 58,500 acres
Indian Service ..... 48,088 acres
Navy Department ..... 90,000 acres
War Department ..... 125,000 acres
Tennessee Valley Authority (includes 44,000 being purchased for National Park Service) ..... 49,000 acres
[3] State Forest ..... 40,000 acres
Game Refuges & Farms ..... 80,645 acres
Forest School ..... 81,590 acres
Other Colleges—Agr. Exp. Stations ..... 2,300 acres
Prison Farms ..... 6,226 acres
Hospitals ..... 3,700 acres
County and Municipal ..... 56,096 acres

Figure 1 will show that a somewhat heavier sample was taken in the Eastern half of the state. Shortage of time forced a reduced sample in the Piedmont and Mountains. Although a higher proportion of counties was included in the Mountains than in the Piedmont, fewer plots were taken in each county, so that the two regions have about the same intensity of sampling. Separate estimates of volume are worked up for the four units, so differences in the degree of sampling do not affect the over-all picture.

More detailed information regarding sawtimber estimates and trends for each of the four sections of the state are shown in Tables 5, 6, and 7.

The 21 sample counties included 4,874,000 acres of forest land, or 23.6 per cent of the state total. Using average volumes per acre from the county inventories to arrive first at regional estimates, and from these to arrive at a state estimate, North Carolina's 18,536,000 acres of commercial forest were found to contain 41,121,000,000 board feet of sawlog-size timber.

Pines totalled 25,245,000,000 board feet, hardwoods and cypress 15,876,000,000 board feet.

Appraisal Findings Indicate Sawtimber Supply Declined During the War Period. Southern Forests were called upon to provide enormous quantities of lumber, pulpwood, and other timber material during the war years. The idea is generally accepted that sawtimber growing stock has been depleted. Since the felling, sawing, and hauling of timber is a much more evident happening than the imperceptible yearly renewal by tree growth, the consensus of public opinion appears to be that the forests are disappearing.

This is not the case in North Carolina, despite the wartime requisitions. The state had a thorough timber inventory in 1937-38—the first cruise in its history by the U. S. Forest Survey. Therefore, comparison can be made between the first and second inventories to get an idea of the general changes that may have been in progress during the eight-year interval. Specifications regarding tree sizes and conditions are the same for one inventory as for the other. No timber cruise is completely accurate, but where the field of sampling is broad, including many millions of acres and billions of board feet, probability of sampling error is reduced. A substantial difference in figures thus would be an indication of trends.

The Forest Resource Appraisal estimate of total sawtimber stand is 6.1 per cent less than the Forest Survey inventory in 1937 and 1938; the pine estimate is 12 per cent lower, while hardwood is unchanged. The percentages are obtained by comparisons with 1938 Forest Survey estimates for the same 21 counties as sampled by the Appraisal.

Appraisal estimates of pine sawtimber are lower for the Northern Coastal Plain, the Southern Coastal Plain, the Piedmont, and Mountain Units, being —13 per cent, —5 per cent, —18 per cent and —11 per cent, respectively.

Table 5
ESTIMATED SAWTIMBER VOLUMES FOR 21 SAMPLE COUNTIES

County	Commercial Forest Acres	Total Volume M Board Feet		Average Volume Per Acre Board Feet		
		Pine	Hardwood	Pine	Hardwood	Total
NORTHERN COASTAL PLAIN						
Beaufort	363,779	612,698	324,127	1,685	891	2,576
Bertie	306,916	1,031,851	618,436	3,362	2,015	5,377
Currituck	80,022	172,928	125,074	2,161	1,563	3,724
Halifax	239,357	337,733	383,210	1,411	1,601	3,012
Tyrrell	213,481	376,154	132,358	1,762	620	2,382
SOUTHERN COASTAL PLAIN						
Bladen	424,795	419,697	313,499	988	738	1,726
Harnett	238,134	300,287	121,686	1,261	511	1,772
Jones	231,931	397,066	83,031	1,712	358	2,070
Pender	465,111	480,460	155,812	1,033	335	1,368
Richmond	191,411	261,850	69,291	1,368	362	1,730
Wayne	175,824	466,461	50,813	2,653	289	2,942
PIEDMONT						
Caswell	152,842	186,926	74,281	1,223	486	1,709
Gaston	85,233	130,747	68,016	1,534	798	2,332
Randolph	303,483	157,811	221,543	520	730	1,250
Wake	306,320	598,856	211,667	1,955	691	2,646
Yadkin	94,122	134,500	91,299	1,429	970	2,399
MOUNTAINS						
Ashe	90,138	*	109,518	*	1,215	1,215
Buncombe	271,632	264,298	330,033	973	1,215	2,188
Caldwell	220,551	313,844	157,694	1,423	715	2,138
Graham	169,100	41,091	224,227	243	1,326	1,569
Jackson	252,724	58,379	327,025	231	1,294	1,525

* Some present, but none on plots tallied.

For hardwood sawtimber, the 1945 estimates are higher for the Northern Coastal Plain, the Piedmont, and the Mountains, being +6 per cent, +7 per cent, and +8 per cent, respectively. The Southern Coastal Plain shows an unaccountably lower estimate of hardwood, —26 per cent less than the 1938 estimate which is out of line with other indicated trends. It is possible that either one or the other of the two inventories may have failed to obtain a representative sample of the hardwood volume in the particular six counties sampled in this unit.

Sawtimber volumes are low in the Mountain region. This is due, as elsewhere, to cutting, but another factor is worth mentioning. Thirty years ago, the Chestnut Blight was introduced into this country and has since killed all the chestnut. Formerly, about ¼ of the timber volume was chestnut, but none is represented in Appraisal volumes.

Survey findings indicate that pine sawtimber volumes are almost 12 per cent less than eight years ago, while hardwood volumes remain about the same as they were in 1938. Since pine has produced the greatest volume and best quality, especially for construction material, this change in composition can be regarded as the worst feature in present trends. Another trend that should cause concern is the decrease in number of operable stands, i. e., individual stands containing at least 50 M. bd. ft. Present pine sawtimber stands are becoming more and more scattered, thus, harvesting becomes more expensive.

Present findings indicate also an increase in the proportion of oak in the Coastal Plain. Few timbermen have a kind word for Coastal Plain oak. It is known that the limited stands of virgin hardwoods in the Mountains and Coastal Plain are decreasing in extent. There is no reason for saving them, but the proportion of high grade hardwood is naturally reduced by their passing.

War-time cutting has helped some hardwood stands. Low-grade and previously non-salable trees that otherwise might never have been cut have been utilized.

SAWTIMBER SUITABLE FOR POLES AND PILING

Trees suitable for poles and piling represent quality pine timber, not only from the standpoint of the higher

Table 6
ESTIMATED SAWTIMBER VOLUMES OF REGIONS OF N. C.

Region, or Survey Unit (see map page)	Total Commercial Forest Acres	Total Volume—M. Board Feet		
		Pine	Hardwood	Total
NORTHERN COASTAL PLAIN (23 counties)	4,140,752	8,704,000	5,445,000	14,149,000
SOUTHERN COASTAL PLAIN (21 counties)	5,607,185	7,548,000	2,580,000	10,128,000
PIEDMONT (35 counties)	5,039,742	6,466,000	3,563,000	10,029,000
MOUNTAINS (21 counties)	3,748,679	2,527,000	4,288,000	6,815,000
STATE (100 counties)	18,536,358	25,245,000	15,876,000	41,121,000

Table 7
COMPARISON OF SAWTIMBER ESTIMATES, 1938 AND 1945
(1938 Estimate by U. S. Forest Survey; 1945 Estimate by Forest Resource Appraisal. Both estimates are based on their respective data from the same twenty-one sample counties.)

	NORTHERN COASTAL PLAIN	SOUTHERN COASTAL PLAIN	PIEDMONT	MOUNTAINS	STATE
	Average Volume Per Acre—Board Feet				
PINE					
F. R. Appr. (1945)	2,102	1,346	1,283	674	1,362
Forest Survey (1938)	2,409	1,417	1,541	762	1,531
HARDWOODS					
F. R. Appr. (1945)	1,315	460	707	1,144	857
Forest Survey (1938)	1,220	637	658	1,061	833
TOTAL: PINE AND HARDWOODS					
F. R. Appr. (1945)	3,417	1,806	1,990	1,818	2,219
Forest Survey (1938)	3,624	2,054	2,199	1,823	2,364
PER CENT THAT 1945 ESTIMATE DIFFERS FROM 1938 ESTIMATE	—5.8	—12.1	—9.5	—0.3	—6.1

prices paid for these products, but also because they would produce the better grades of lumber if cut for that purpose. A count of trees suitable for poles or piling, 25 feet in length or longer, was made. Results are shown in Table 8. This table indicates that many of the pine trees in our present stands are straight and clean, and the proportion appears to be as high as in other years.

Many of the trees suitable for poles and piling are so widely scattered that it would be impractical for buyers to collect them. Lack of markets or knowledge will, in other cases, cause a large share of these well-formed trees to be used for lumber or pulpwood.

Table 8
ESTIMATED NUMBER OF POLES AND PILING FOR SAMPLE COUNTIES AND FOR REGIONS—PINE

County & Region	Lengths 25-35 ft.	Lengths 40 ft. or over
	M. Pieces	
Beaufort	798	215
Bertie	763	1,007
Currituck	13	90
Halifax	100	207
Tyrrell	160	183
Total For 23 Counties of N. Coastal Plain	6,386	5,790
Bladen	424	*
Harnett	240	80
Jones	239	85
Pender	451	41
Richmond	273	170
Wayne	1,097	946
Total for 21 Counties of S. Coastal Plain	8,837	4,253
Caswell	169	*
Gaston	134	12
Randolph	232	18
Wake	898	373
Yadkin	221	13
Total For 35 Counties of Piedmont	8,771	2,268
Buncombe	162	*
Caldwell	153	*
Total for 21 Counties of Mountains	1,162	*
State Total—100 counties	25,156	12,311

* None tallied in sample.

THE SUPPLY OF TIMBER BELOW SAWTIMBER SIZE

The great majority of trees are not of sawlog size. All sound and reasonably straight trees, 6"-8" d.b.h. for softwoods, and 6"-12" d.b.h. for hardwoods, are classed as "sound under-sawlog-size."

This material was considered potential sawtimber, if the individual stem was properly spaced of desirable species and of good enough promise to grow into a sawlog tree. A maple, a scrubby oak, or bay tree, even though sufficiently sound and straight to meet specifications, was not counted if it were judged to be on a too dry or too poor site to grow into sawtimber. Dogwood and other understory trees were not counted. For this reason, Appraisal estimates of hardwood under-sawlog size volume are believed to be conservative, particularly in the Coastal Plain where the small hardwoods often present varied and puzzling conditions that increase the burden on an appraiser's judgment.

The quantity of under-sawlog size material indicates the extent to which present sawtimber volumes will be augmented in the next 10 to 20 years. For example, Bertie, Wake, Yadkin, and Randolph show an increase in the volume of this class. This means more timber to support cutting in future years.

Table 11 compares Appraisal findings with those from the inventory made by the U. S. Forest Survey in 1937. Appraisal cruising and aerial photo-reading were designed primarily to estimate sawtimber. Estimates of under-sawlog may not be as accurate, but a wide difference when compared with the earlier survey probably denotes a trend—except in one case. The Appraisal shows a lower hardwood volume for the Coastal Plain units. It appears that the Appraisal specifications for the hardwoods were slightly different and tended to exclude some minor types that were counted by the Forest Survey, thus tending to make the Appraisal figures more conservative. No reason can be seen for a decline in under sawlog-size hardwood volume in the Coastal Plain as cutting in this class has not increased and fires are no worse than in former years.

The comparison does indicate a slight increase in hardwood volumes in the Piedmont and Mountain regions. This is believed to reflect a definite trend. Differences between the two inventories indicate an increase in small pine timber in the Southeastern Coastal Plain and the Piedmont.

A gain in under-sawlog pine volumes in the Southern Coastal Plain can probably be ascribed to the fact that this unit had been rather thoroughly cut-over at the time of the 1937 inventory. It still is, of course, but cut-over stands have a tendency to grow back. By 1945 added numbers of trees on the great stretches of cut-over land were big enough to be counted.

It should be pointed out that the under-sawlog size volume of this unit is still the lightest of any unit. The sawtimber volume is also light. Considering its rich potentialities for growing big crops of pine timber, the Southern Coastal Plain unit is in worse shape than the other three regions. Not only does it have less timber of all sizes, but later figures will show it has more forest fires. Cutting is close; fires are bad.

Most counties in this unit have another condition that complicates the timber growing problem: they have big areas of poor sand ridges where oaks and other hardwoods prove miserable failures for commercial timber. The Sandhills come to mind; however, Bladen, Wayne, and other counties in this region also have poor sand stretches. That is one reason the volumes of under-sawlog hardwoods for the unit are only half as good as other units. Hardwoods on these poor sites are sparse, scrubby, and largely unpromising as timber trees. In other words, these areas must grow pine or go unproductive.

The pine under-sawlog stand is also light, considering the fact that woods cut over years ago should eventually show re-establishment of the small trees. Forest fires

which continually destroy small trees by the million, must be counted as one of the main causes. Another cause of understocking—one that is gradually becoming more serious—is the frequent lack of pine seed trees on cut-over lands.

While under-sawlog size volume is light in this unit, one favorable feature is the way the proportion of pine reproduction continues to maintain itself on forest lands that are not of "old field" origin in the sample counties of the South Coastal Plain.

Piedmont temporarily gains in under-sawlog pine. The Piedmont unit also shows an increase in under-sawlog pine. This is a temporary condition. It is apparent that pine is to be succeeded by hardwoods in this region. This trend is written in the laws of nature, and no one can be blamed for it, although it may be pointed out that the trend is being hastened by heavy cutting of pine and light cutting of hardwoods. Hardwoods grow up under pines and eventually take over the ground. The climax type is hardwoods; establishment of pine stands is due to happenings which temporarily upset the natural scheme of plant succession. An opening is created by an unnatural disturbance. From scattered pines that have always been present on dry ridges, if nowhere else, winged seeds invade and stock the opening.

If the land "belongs" to hardwoods, why does the Piedmont now have more pine than hardwood in both sawlog and undersawlog categories? The answer is: land clearing and abandonment. At least half of the Piedmont forest has been under the plow at one time or another during the last 150 years. High-yielding stands of pine grew up in the fields that were constantly being abandoned. By the time earlier old field stands have been cut one, two, or three times, the oaks, hickories, and other hardwoods have taken possession. A number of central Piedmont counties are well along the road to the hardwood climax. Of those sampled by the appraisal, Randolph is the best example. It had only 1¾ cords of under-sawlog pine per average acre. The bulk of this volume was concentrated in younger old field pine stands. Stands of hardwood, almost devoid of pine, occupy most of the land now. On the ground, under many hardwood stands, are found rotted pine stumps, stump holes, and old pine knots which have resisted decay after fallen pine trees have moldered back to earth. Pine stands once occupied this land.

WAKE COUNTY—AN ABANDONED COTTON FIELD

A glance at Table 9 shows more under-sawlog pine in Wake County than any other Piedmont County—or any other county in the state. Wake County represents sections of the Piedmont where cotton and corn growing have been almost completely discontinued in recent decades. Old

Table 9
ESTIMATED VOLUME IN SOUND UNDER-SAWLOG-SIZE TREES
FOR 21 SAMPLE COUNTIES

County	Commercial Forest Acres	Total Volume M Cords		Average Volume Per Acre Cords		
		Pine 6″-8″	Hardwood 6″-12″	Pine 6″-8″	Hardwood 6″-12″	Total
NORTHERN COASTAL PLAIN						
Beaufort	363,779	520	677	1.43	1.86	3.29
Bertie	306,916	752	1,228	2.45	4.00	6.45
Currituck	80,022	69	285	.86	3.56	4.42
Halifax	239,357	395	601	1.65	2.51	4.16
Tyrrell	213,481	386	557	1.81	2.61	4.42
SOUTHERN COASTAL PLAIN						
Bladen	424,795	981	603	2.31	1.42	3.73
Harnett	238,134	317	538	1.33	2.26	3.59
Jones	231,931	471	220	2.03	.95	2.98
Pender	465,111	912	721	1.96	1.55	3.51
Richmond	191,411	362	331	1.89	1.73	3.62
Wayne	175,824	295	229	1.68	1.30	2.98
PIEDMONT						
Caswell	152,842	411	449	2.69	2.94	5.63
Gaston	85,233	162	216	1.90	2.54	4.44
Randolph	303,483	498	1,417	1.64	4.67	6.31
Wake	306,320	1,608	806	5.25	2.63	7.88
Yadkin	94,122	326	390	3.47	4.14	7.61
MOUNTAINS						
Ashe	90,138	7	332	.08	3.68	3.76
Buncombe	271,632	242	902	.89	3.32	4.21
Caldwell	220,551	311	655	1.41	2.97	4.38
Graham	169,100	78	680	.46	4.02	4.48
Jackson	252,724	124	801	.49	3.17	3.66

field pine stands are everywhere. Many of them date back to the big collapse of cotton prices following World War I, the arrival of the boll weevil, and the prosperous '20's when Negro tenants left the farm in droves to seek city jobs. Since a large proportion of Wake's old-field stands are young, the under-sawlog pine figures would naturally reflect the bulk of their volume. Aerial photo-interpretation showed more than one-third of Wake County to be occupied by young old-field pine, averaging about 10 cords per acre of under-sawlog volume. These are the stands that will produce high yields of sawtimber in the future.

If the agricultural practices of a county still features the cycle of land clearing and abandonment, that county will continue to have stands of pine. Apparently, if the sample counties are representative, the cycle is still active enough in the Piedmont to keep up the volume of under-sawlog-size pine. However, farm leaders are successfully working to end this primitive type of farming. Soil conservation practices will enable good lands to stay productive, so they will not be abandoned; therefore, this time-honored cycle cannot be depended upon indefinitely to renew the source of pine timber. Whether foresters can develop practical means of keeping pine in the Piedmont remains to be seen. Probably it can be done if land owners can be persuaded to expend the necessary effort.

Table 10.
ESTIMATED VOLUME IN SOUND UNDER-SAWLOG-SIZE TREES

Region, or Survey Unit (See map page vii	Total Commercial Forest Acres	Total Volume—M. Cords Pine 6"-8"	Hardwood 6"-12"	Total
Northern Coastal Plain (23 counties)	4,140,752	7,288	11,511	18,799
Southern Coastal Plain (21 counties)	5,607,185	10,822	8,579	19,401
Piedmont (35 counties)	5,039,742	16,078	17,539	33,617
Mountains (21 counties)	3,748,679	2,849	12,597	15,446
State (100 counties)	18,536,358	37,037	50,226	87,263

Forestry in Yadkin County deserves special comment. This county possessed the second highest under-sawlog-size pine volume per acre in the state. In Wake, the big land abandonment movement occurred some years ago; in Yadkin it seems to be on a perpetual basis. The county is packed with small farms, each of which grows a few acres of tobacco. Not having much smooth land, owners have to cultivate up-and-down land; and, so far, terracing and contour plowing have not been adopted very widely. Consequently, land soon erodes and becomes unsuitable for tobacco culture. Farmers abandon old fields as they clear new ones, and the annual "turnover" is about 2 per cent of the land.

This system may not be the best farming, but the county is more successful than any other sampled in the matter of permanently maintaining pine stands. If this kind of tobacco farming keeps up, Yadkin will have plenty of pine in future years, and its stands will yield high above the average.

(Note: Throughout this report, whenever a "sample" county is discussed, it should be kept in mind that the sample illustrates conditions in several other counties in the section.)

OTHER MATERIAL SUITABLE FOR CORDWOOD USE

After sawlogs are cut from a tree, wood usuable for fuel or pulp remains in the upper-stem, or top. Upper-stem material below four inches in diameter was not counted.

Table 12 shows the volume, in cords, of all sound trees over five inches d.b.h., except that upper-stem and limbs

Table 11.
COMPARISON OF ESTIMATES OF SOUND UNDER-SAWLOG-SIZE VOLUMES, 1938 AND 1945

(1938 Estimate by U. S. Forest Survey; 1945 Estimate by Forest Resource Appraisal. Both estimates are based on their respective data from the same twenty-one sample counties.)

	Northern Coastal Plain	Southern Coastal Plain	Piedmont	Mountains	State
	Average Volume Per Acre—Standard Cords				
Pine					
F. R. Appr. (1945)	1.76	1.93	3.19	.76	2.00
Forest Survey (1938)	1.69	1.29	2.47	.92	1.58
Hardwoods					
F. R. Appr. (1945)	2.78	1.53	3.48	3.36	2.71
Forest Survey (1938)	3.29	1.98	3.32	2.82	2.63
Total: Pine and Hardwoods					
F. R. Appr. (1945)	4.54	3.46	6.67	4.12	4.71
Forest Survey (1938)	4.98	3.27	5.79	3.74	4.21
Per Cent That 1945 Estimate Differs from 1938 Estimate	—8.8	+5.8	+15.1	+10.1	+11.9

of hardwood sawtimber are not included. Table 13 shows the grand total of all sound wood material including that in culls, upper-stem, and limbs of hardwood sawtimber.

Table 12 shows an interesting fact: Its final total figure of 201 million cords varies less than 2 per cent from the estimate made by the Forest Survey eight years ago. This seems to bear out an important point, namely, that the total volume of wood material may remain constant, or even increase, although sawtimber declines materially. Pine sawtimber is 12 per cent less by this inventory, when compared with the one eight years earlier, although the overall wood volume seems to be about the same.

Further comparisons with the 1938 survey, always restricted to the same 21 sample counties, show very small differences by regions. Coastal Plain Units are about 5 per cent lower by the Appraisal; the other regions are a little higher.

With regard to upper-stem cordwood volumes, the tendency has been for pulpmills to use increasing amounts of the pine tops following operations of sawmills. Farmers cut topwood for tobacco curing and other home fuel use where the logged areas are near the farm, and accessible. Unfortunately, however, the bulk of such material goes unused.

Table 12
VOLUME OF ALL SOUND TREES, IN CORDS
(Does not include sound material in cull trees, nor the upper stem and limbs of hardwood sawtimber.)

	North Coastal Plain	South Coastal Plain	Piedmont	Mountains	State
PINE		(M Cords)			
Sawlog material	20,124	17,440	15,473	5,886	58,923
Upper stems sawlog trees	4,182	3,645	3,730	1,425	12,982
Trees under sawlog size	7,288	10,822	16,078	2,849	37,037
TOTAL PINE	31,594	31,907	35,281	10,160	108,942
HARDWOODS					
Sawlog material	13,830	6,561	9,072	12,297	41,760
Trees under sawlog size	11,511	8,579	17,539	12,597	50,226
TOTAL HARDWOOD	25,342	15,140	26,611	24,894	91,986
TOTALS	56,935	47,047	61,892	35,054	200,928
Average Cordwood Volume Per Acre	13.75	8.39	12.28	9.45	10.84

Table 13
TOTAL VOLUME IN CORDS, FROM ALL SOURCES
(Includes all sound trees over 5" d.b.h., upper stems and limbs of hardwood sawtimber, and sound material in cull trees.)

	North Coastal Plain	South Coastal Plain	Piedmont	Mountains	State
		(M Cords)			
TOTAL VOLUME ALL SOUND TREES (from Table 12)	56,935	47,047	61,892	35,054	200,928
UPPER STEMS & LIMBS OF HARDWOOD SAWTIMBER	6,670	3,302	4,696	5,008	19,676
TOTAL	63,605	50,349	66,588	40,062	220,604
SOUND MATERIAL CONTAINED IN CULL TREES IN 1938*	10,240	9,438	8,715	9,329	37,722
TOTAL					257,863

* From U. S. Forest Survey, 1938. It seems unlikely that amount of cull has diminished. Cull material is nearly 90% hardwood.
Above figures do not include any chestnut. Dead chestnut, including upper stems, was estimated to be 11,719,900 cords in 1938. The amount has diminished considerably through cutting and decay.

SUPPLY OF PULPWOOD

It may be desired to arrive at pulpwood figures from the various tables given, some of which are in board feet and others in standard cords.

Volume of sawtimber trees is expressed in board feet. Pine trees having a thousand board feet of lumber will yield approximately 2 ¾ cords of pulpwood, if the upper-stem is utilized. An interested person can make his own estimate as to the proportion of sawlog volume that is in trees of suitable size for pulpwood. For example, Harnett County is estimated to have 300 million feet of pine sawtimber (Table 5). If the assumption is made that 40 per cent of this volume, or 120 million board feet is in diameters suitable for pulpwood, and 1 M board feet will produce 2 ¾ cords, the material suitable for this purpose would amount to 330,000 cords. This does not include material below 8 inches, d.b.h.

The under-sawlog-size pine volume in Harnett County (Table 9) is 316,000 cords. Theoretically, all this material might be suitable for pulpwood. The total pine pulpwood supply for Harnett County is thus figured at 646,000 cords. All this material may not be available, due to inaccessibility and scattered condition of individual trees, but comparison may be made with other counties.

Hardwoods are being used increasingly for pulp, but the present supply far exceeds the demand. Under-sawlog-size hardwood volume represents trees 6"-12" d.b.h. This is only slightly less than the range of pulpwood size under present usage. Harnett has a total hardwood under-sawlog volume of 538,000 cords, to which can be added the sound wood in rough hardwood culls.

Table 13 adds the cordwood in culls and tops of sawtimber hardwoods to Table 12. The upper-stem and limbs of hardwoods are not being used commercially at present, and may be considered as additional cull material.

THE CULL PROBLEM

Cull tree volume is nearly 90 per cent hardwood, and North Carolina has the astounding total of nearly 40 million cords of this material. These unwanted trees could sustain pulp, fibreboard, or chemical wood industries if the sound wood could be brought out of the forest in a practical way, and if the industries needed it and were adapted to processing it.

Many people, in times past, have called for industries to use hardwood culls, topwood, low-grade, and mill waste. One authority recently made this statement, "Markets for non-sawtimber hardwoods is the most urgent single measure needed for improving the value of North Carolina's timber stand."

So long as wood is abundant, intensified utilization should not be expected. This holds true, even in the relatively short period of American lumbering. First, the lumbermen were interested only in the big clear logs; over the years, they have lowered their demands until today they will take knotty pine tops and formerly-despised species. Ten years ago, many Southern pulp mills would take only pine; later they accepted gum, and now some are beginning to take oak. As timber of the desired kinds decreases, industry learns to use other kinds. It becomes less wasteful. Forestry does not begin until scarcity arrives.

Decline of sawtimber volume and of pine may be a partial blessing if it means the utilization of all kinds of hardwood material. Why not encourage the same result, without allowing sources of pine seed to become badly depleted, by establishing the requirement that a certain number of pine seed trees be left per acre

Where are the culls? Culls were counted by size classes in each sample county. No volume determinations were made for individual trees. On a per-acre basis, Bertie, Currituck, Halifax, Gaston, Randolph, Buncombe, and Jackson led among the 21 sample counties. Culls are well distributed over the state; within a county they will be concentrated wherever hardwood stands are found. Heavy accumulations of cull are found in the big river swamps of the Coastal Plain. The Great Swamp of Currituck, although logged some years ago, appears to be one big jungle of culls and low-grade material. Culls are even more scattered in the hardwood stands of the Piedmont and Mountains.

TIMBER HARVESTING IN NORTH CAROLINA

Five out of ten trees cut annually in North Carolina go to the sawmills. Three out of ten are made into fuel-wood, principally for farm heating purposes, as North Carolina has the second largest farm population in the Union. Pulpwood and veneer account for most of the remaining trees to go down before the axe and saw. Table 14 tells the complete story of 1943 forest drain, for the four regions and for the state.

While Table 14 represents 1943, a war year, nevertheless cutting was only about 10 per cent higher than the average for 1937 through 1940.

This table is from Forest Survey Release No. 18, "N. C. Forest Growth and Drain 1937-1943."

The last 3 columns headed "All sound trees—5.0" d.b.h. and larger" includes the following classes of cordwood material: Complete trunk of sawtimber and under-sawlog-size trees to a minimum 4" top; sound wood in hardwood limbs 4" or larger.

Study of the Table reveals that the proportions of trees cut for lumber, fuel, pulp, and veneer are about the same in each region as they are for the state as a whole. Minor deviations arise from the heavier cutting of fuel wood in the Piedmont (because of the greater farm population) and also because less veneer is cut in the Piedmont and Mountain regions.

There exist big differences in the money returns to be realized from different tree products. There are two kinds of returns, those to the timber grower, and those to the business economy through which people earn livelihoods in manufacturing, transporting, and the providing of various services.

Generally speaking, North Carolina does not get the best all-round return from its lumber industry, since a large part of the production ends up as plain lumber, a commodity not far removed from the raw material stage. Much of the output is shipped from the state. A thousand board feet of lumber would have had an average selling value of $45 to $50 in the last few years. This is much higher than previous years and has enabled sawmill men to pay surprisingly high stumpage prices ranging from $10 to $20.

A thousand board feet of logs going to a veneer plant will be manufactured into veneers worth around $200 or more. If a thousand board feet of logs went to a pulp mill

Table 14

FOREST DRAIN BY SURVEY UNIT, COMMODITY AND SPECIES GROUP, NORTH CAROLINA — 1943

Survey unit and commodity	Saw timber			All sound trees—5.0" d.b.h. and larger		
	Softwoods[1]	Hardwoods[2]	All species	Softwoods[1]	Hardwoods[2]	All species
	M. bd. ft.	M. bd. ft.	M. bd. ft.	Cords	Cords	Cords
Southern Coastal Plain:						
Lumber	340,300	50,000	390,300	910,000	121,300	1,031,300
Veneer	1,500	63,900	65,400	4,100	155,200	159,300
Cooperage	—	—	—	—	—	—
Pulpwood	40,700	1,100	41,800	151,400	3,600	155,000
Excelsior	—	—	—	—	—	—
Other manufactures	1,900	6,500	8,400	4,400	15,700	20,100
Hewn crossties	7,500	13,100	20,600	18,300	31,700	50,000
Poles and piles	1,800	—	1,800	8,800	—	8,800
Fuelwood	107,700	27,300	135,000	553,400	312,100	865,500
Miscellaneous farm use	3,200	2,100	5,300	27,400	14,800	42,200
Total	504,600	164,000	668,600	1,677,800	654,400	2,332,200
Northern Coastal Plain:						
Lumber	324,400	60,600	385,000	829,000	143,600	972,600
Veneer	700	45,600	46,300	1,900	108,000	109,900
Cooperage	8,900	—	8,900	22,700	100	22,800
Pulpwood	34,400	5,900	40,300	112,500	16,200	128,700
Excelsior	—	—	—	—	—	—
Other manufactures	1,200	2,700	3,900	2,700	7,000	9,700
Hewn crossties	2,000	4,100	6,100	4,500	9,700	14,200
Poles and piles	17,400	300	17,700	44,700	700	45,400
Fuelwood	71,700	17,800	89,500	366,600	200,800	567,400
Miscellaneous farm use	2,100	1,400	3,500	18,400	9,900	28,300
Total	462,800	138,400	601,200	1,403,000	496,000	1,899,000
Piedmont:						
Lumber	540,400	96,800	637,200	1,598,900	256,100	1,855,000
Veneer	100	26,900	27,000	600	71,300	71,900
Cooperage	—	—	—	—	—	—
Pulpwood	31,600	3,900	35,500	129,700	15,500	145,200
Excelsior	300	—	300	4,200	400	4,600
Other manufactures	1,200	7,500	8,700	5,300	29,400	34,700
Hewn crossties	200	20,700	20,900	400	54,700	55,100
Poles and piles	300	—	300	900	—	900
Fuelwood	174,100	42,100	216,200	883,100	434,800	1,317,900
Miscellaneous farm use	3,500	2,000	5,500	28,100	15,100	43,200
Total	751,700	199,900	951,600	2,651,200	877,300	3,528,500
Mountain:						
Lumber	88,100	116,200	204,300	260,800	325,400	586,200
Veneer	—	8,200	8,200	—	23,100	23,100
Cooperage	—	200	200	—	600	600
Pulpwood	16,500	5,500	22,000	71,700	46,700	118,400
Excelsior	100	100	200	400	300	700
Other manufactures	300	3,800	4,100	900	22,100	23,000
Hewn crossties	1,300	9,800	11,100	4,000	27,400	31,400
Poles and piles	—	—	—	—	—	—
Fuelwood	15,100	25,800	40,900	94,500	251,500	346,000
Miscellaneous farm use	800	1,700	2,500	7,400	13,800	21,200
Total	122,200	171,300	293,500	439,700	710,900	1,150,600
State of North Carolina:						
Lumber	1,293,200	323,600	1,616,800	3,598,700	846,400	4,445,100
Veneer	2,300	144,600	146,900	6,600	357,600	364,200
Cooperage	8,900	200	9,100	22,700	700	23,400
Pulpwood	123,200	16,400	139,600	465,300	82,000	547,300
Excelsior	400	100	500	4,600	700	5,300
Other manufactures	4,600	20,500	25,100	13,300	74,200	87,500
Hewn crossties	11,000	47,700	58,700	27,200	123,500	150,700
Poles and piles	19,500	300	19,800	54,400	700	55,100
Fuelwood	368,600	113,000	481,600	1,897,600	1,199,200	3,096,800
Miscellaneous farm use	9,600	7,200	16,800	81,300	53,600	134,900
Total	1,841,300	673,600	2,514,900	6,171,700	2,738,600	8,910,300

[1] Cypress included with softwoods.
[2] Chestnut is not included.

it would probably produce $80 worth of semi-finished pulp. A thousand board feet of long poles would be worth considerably more after treatment in a wood preserving plant than if cut up for lumber.

Since half the trees cut are manufactured into lumber, which rates rather low on the income scale, it would be a good trend to have more trees go into veneer and poles, and to re-manufacture as much lumber as possible in local plants making furniture, flooring, small-wood products, and so on.

As the pulp mills do not have to use good lumber trees, stumpage prices are usually lower for pulpwood. It is desirable to utilize as many of these non-lumber trees as possible for the production of pulp. Fuelwood requirements could be met very largely from non-lumber trees. However, about half of the fuelwood cut in North Carolina is said to be cut from portions of sound trees that would produce lumber, or even poles and veneer. Agricultural educators should strive to improve this practice.

With such a large lumber cut, North Carolina can make progress through development of more plants to re-manufacture lumber. At present there are pleasing situations in many spots. For example, Randolph County has dozens of small manufacturing plants that use oak, poplar and pine. The grades of hardwood in the county are not high, but these shops enable the county to extract a high income from its timber crop. Average grade timber sells very profitably and utilization is close. One 300-acre tract, mostly oak, sold for $27,000 recently.

The shops make all kinds of furniture, and novelties. One farmer has installed a shop in his barn, and makes lawn furniture in his spare time. In Yadkin County there is a "Little Red Wagon" factory, which makes children's wagons in normal times. Haywood County is noted for its Hillbilly Industries which makes all kinds of fancy novelties and employ many people.

This is the type of enterprise found in Northern New England. The people there can take a few thousand feet of logs, lumber, or even cordwood, and make excellent yearly profits from manufacture of spools, handles, clothes pins, games, and other items. North Carolina is already far ahead of other Southern states in skilled wood manufacturing. Of course, lumber will always be needed, and the price may stay high. To get the most from the timber crop, as much wood as possible should be carried beyond the lumber stage. To saw trees into lumber for export is not the way to grow prosperous.

MINIMUM SIZE OF TREES CUT

Over most of the state, the minimum diameter to which sawlog trees are cut does not appear to have changed materially. Measurements of stumps on 112 plots, where cutting had occurred, showed average minimum stump diameters for pine sawtimber (outside bark) of 13 inches in the North Coastal Plain, 11 inches in the South Coastal Plain, 10 in the Piedmont, and 11 in the Mountains. For hardwood, sawtimber minimum size stumps averaged 15 ½ inches in the North Coastal Plain; (data too scanty in South Coastal Plain); 13 inches in the Piedmont; and 13 inches in the Mountains. The average of *minimum* stump diameters for pulpwood was 6 ½ inches. These figures do not imply that all trees of the above stump diameters were cut. Usually, just the smoother ones, where convenient to log, were taken.

Availability of Stumpage. Many lumbermen were questioned about available stumpage. About half of them figured they would have to curtail operations; others said the timber was there, but stumpage prices were too high. Several commented that with education of timber owners, and fire protection on their lands, sufficient timber could be grown to supply the mills.

The Southern Box and Lumber Co., Wilmington, said, "We are planning to operate forever." They own land, protect it, and cut under a plan.

Another company said, "We have bought land with the idea of trying to have 1000 acres of reproducing pine lands for each 1000 feet sawed per day. Other sawmill operators are becoming like-minded." Then if each acre could grow one board foot per day, the company would have a perpetual supply of their own. Under intensive forestry, pine stands can do it.

The companies owning or buying land are the most optimistic, and they will lead in good timber farming. All pulp companies are acquiring lands so they will always have a supply of raw material. If stumpage becomes scarce they can raise stumpage prices, or start using more hardwoods, also slabs, tops, and culls.

Observations made on cut-over areas showed that the stump diameters were just as small on cuttings made before the war as those made during the war period.

Top utilization was closest in the Piedmont. Of all state cuttings, 7 per cent represented wasteful top utilization, 25 per cent fair, and 67 per cent good. This rating includes pulpwood and fuelwood cut from tops, when utilized.

Percentages of original sawlog volume removed in sawlog cutting were estimated. They are about the same in the South Coastal Plain, Piedmont, and Mountains, being slightly over 80 per cent. In the North Coastal Plain, cutting has been less heavy. The sawlog trees not cut were often hardwoods. Hickory is still mostly left in the woods. New power chain saws make it possible to utilize more low-grade logs.

LUMBER PRODUCTION

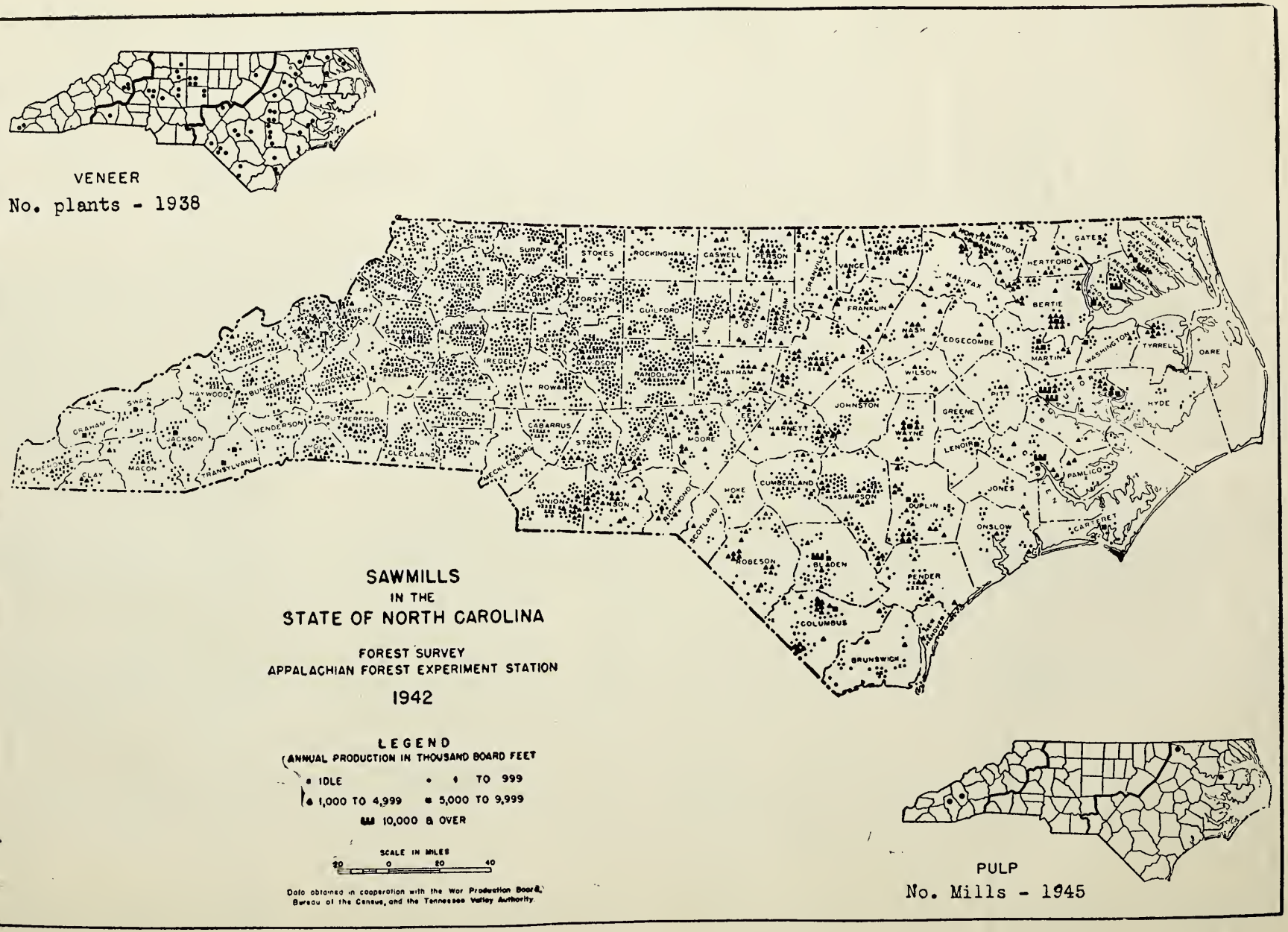
If one lacks faith in the ability of North Carolina's forests to grow timber, let him consider the remarkable record of sustained lumber output for 50 years.

Year	Production	Year	Production
1889	670,000 M bd. ft.	1925	1,708,000 M bd. ft.
1899	1,287,000 M bd. ft.	1930	815,000 M bd. ft.
1905	1,081,000 M bd.ft.	1935	685,000 M bd. ft.
1910	1,825,000 M bd. ft.	1940	1,377,000 M bd. ft.
1915	1,537,000 M bd. ft.	1942	1,692,000 M bd. ft.
1920	1,450,000 M bd. ft.	1944	1,634,000 M bd. ft.

The great bulk of the lumber is cut by portable mills, now numbering over 3,000. They operate all over the state, but (Figure 3) are more concentrated in the Piedmont. Larger mills with production over 5 million feet yearly saw 1/7 of the lumber and are located mostly in the Coastal Plain.

In recent years, the Census has reported production by counties, the Census in 1942 being more intensive than those made in other years. The figures in Table 15 show lumber sawed by mills in each county for the year 1942. These figures differ, in many cases, from the amount of timber logged in each county as some mills draw logs from several counties.

No lumber production figures were collected by the ap-


VENEER
No. plants - 1938
SAWMILLS
IN THE
STATE OF NORTH CAROLINA
FOREST SURVEY
APPALACHIAN FOREST EXPERIMENT STATION
1942
LEGEND
(ANNUAL PRODUCTION IN THOUSAND BOARD FEET
IDLE
1 TO 999
1,000 TO 4,999
5,000 TO 9,999
10,000 & OVER
SCALE IN MILES
20 0 20 40
Data obtained in cooperation with the War Production Board, Bureau of the Census, and the Tennessee Valley Authority.
PULP
No. Mills - 1945

praisal, but it is believed that existing drain figures for lumber are too low. Black market transactions do not find their way into reports of lumber cut. Collecting lumber production data is a very difficult job at any time, and has been made doubly so in recent years.

The appraisal determined areas cut over for logs, wood, and pulp in each sample county, according to the proportion of plots having such cuttings. Bertie County, for example, showed that an estimated 114,000 acres was cut for logs in five years. If one assumes the average log cutting removed to be 3 M per acre, then 340 million feet were cut in five years, or 70 million per year. The Census shows 49 million sawed in 1942, a high year.

Halifax County was indicated to have had 87,000 acres cut over for logs in the previous five years. Assuming 2 M cut per acre, this would be 175 million feet cut, or 35

Table 15
PRODUCTION OF LUMBER BY COUNTIES
1942

County	Lumber Sawed (M ft.,b.m.)	County	Lumber Sawed (M ft.,b.m.)
Alamance	7,721	Jackson and Transylvania	24,692
Alexander	11,529	Johnston	18,367
Alleghany	3,871	Lee	13,027
Anson	33,219	Lenoir and Pitt	18,015
Ashe	8,075	Lincoln	8,870
Avery	6,512	McDowell	6,976
Beaufort	51,567	Macon	11,376
Bertie	49,055	Madison	4,264
Bladen	42,563	Martin	26,300
Brunswick & New Hanover	11,364	Mecklenburg	3,884
Buncombe	9,683	Mitchell	4,335
Burke	12,687	Montgomery	32,162
Cabarrus	1,232	Moore	33,180
Caldwell	17,978	Nash	22,358
Camden	447	Northampton	35,356
Carteret & Jones	9,681	Onslow	9,587
Caswell	16,996	Orange	21,408
Catawba	20,598	Pamlico	8,073
Chatham	47,438	Pasquotank	28,165
Cherokee & Graham	17,301	Pender	18,753
Chowan & Perquimans	24,246	Person	19,177
Clay	7,990	Polk	7,798
Cleveland	7,520	Randolph	34,778
Columbus	45,558	Richmond	17,420
Craven	35,139	Robeson	27,972
Cumberland	23,264	Rockingham	13,388
Currituck	1,605	Rowan	9,016
Dare & Hyde	2,865	Rutherford	18,233
Davidson	19,332	Sampson	45,126
Davie	8,268	Scotland	3,941
Duplin	42,486	Stanly	18,046
Durham	16,266	Stokes	15,543
Edgecombe	8,083	Surry	17,687
Forsyth	9,861	Swain	13,475
Franklin	27,659	Tyrrell	13,300
Gaston	4,595	Union	18,846
Gates	4,115	Vance	5,708
Granville	41,819	Wake	48,127
Greene	1,076	Warren	32,027
Guilford	35,398	Washington	10,694
Halifax	18,427	Watauga	10,724
Harnett	27,387	Wayne	20,908
Haywood	12,310	Wilkes	40,942
Henderson	2,287	Wilson	9,953
Hertford	14,636	Yadkin	13,365
Hoke	5,792	Yancey	10,543
Iredell	18,240		
State Total	1,691,536		

million per year. The Census shows 18 million feet sawed. These calculations of course prove nothing, but do show one reason for the supposition that lumber drain may be higher than reported. Some counties came out about right on these guess-calculations. Sample plots indicated that Halifax County had an additional 38,000 acres cut over for pulpwood in five years.

PULPWOOD PRODUCTION

Production figures by counties are not available for publication. Information for 1942 has been drawn upon to point out sections of the various units where cutting was concentrated in that year.

Northern Coastal Plain: Halifax and Northampton counties accounted for 40 per cent of the unit production. Bertie, Gates, Washington, and Hertford counties produced 40 per cent of the unit total. Approximately 5 per cent of the volume cut was hardwood material.

Southern Coastal Plain: Pender, Bladen, and Brunswick accounted for 60 per cent of pulpwood cut in the unit. Sampson, Duplin, Robeson and Onslow were next, their combined production amounting to 25 per cent of unit total. Hardwood was negligible.

Piedmont: With cutting widely distributed, Chatham and Rockingham accounted for 30 per cent, with Warren, Rutherford, and Wake totaling another 20 per cent. The rest of the production came from another 21 counties. Approximately a tenth of Piedmont production was hardwood.

Mountain Unit: Cutting occurred in all 21 counties. Cherokee and Graham accounted for 30 per cent of the total, Haywood, Swain, and McDowell making up another 25 per cent, half of the total being hardwoods.

Pulpwood production in the Piedmont rose sharply in 1943, but declined in the Coastal Plains. This trend was caused by labor and hauling factors under war-time shortages.

North Carolina pulp production has been rising steadily, as follows:

1937	240 M cords
1938	290 M cords
1939	315 M cords
1940	512 M cords
1941	582 M cords
1942	606 M cords
1943	547 M cords

FUELWOOD CUTTING

The amount of wood cut for heating purposes is related to: (1) the number of people in rural areas; (2) the amount of tobacco produced.

The average farm family is said to use over 12 cords per year for household purposes. The average per small town and city family is considerably less, but it is still more than one might guess—five and two cords, respectively.

The amount of tobacco cured per cord of wood is estimated to be 600 pounds. Big tobacco crops of recent years have required nearly a million cords of wood despite the gradual trend toward the use of coal and oil.

Fuelwood is another item of drain that is difficult to measure accurately, because farmers themselves do not know how much they use. Undoubtedly, fuelwood use has dropped substantially, owing to labor shortage during the war period. County agents and Soil Conservation Service technicians were asked how much fuelwood cutting had increased or decreased. Only one, in Chatham County, said there was an increase. Eighty per cent of these farm counsellors said cutting had decreased, the average estimate of decrease being 20 per cent.

DEGREE OF SATISFACTORY STOCKING

One may compare the stocking of an acre of forest land with an acre of corn. Corn-land yields, in bushels per acre, depend on the stand obtained from planting, fertility of soil, season, and competition from weeds and insects. Given an acre of land that could produce 50 bushels per acre, suppose the yield was 25 bushels, because of poor germination that gave a scattered stand; rank weed growth from lack of cultivation that choked out part of the crop, and insects destroying still other stalks. It could be stated that the acre was only 50 per cent stocked, and gave 50 per cent of a crop. This is analagous to stocking on the forest area. If it has only half as many stalks, or trees, as it should have, then the yield will be one-half of capacity.

What is satisfactory stocking of forest land in the different sections of North Carolina? This question could not be answered definitely by the various agencies contacted. The consultants, through a check of existing literature, and through personal knowledge of managed forest areas, decided on a set of standards. The standards represent the average stand per acre that can be maintained on periodically cut forest areas under practicable management. Standards were set for sawtimber, under-sawtimber-size, and reproduction.

The standards per acre for the various regions are as follows (meaning well-distributed stems):

1. *Northern and Southern Coastal Plain.* Eight thousand board feet of sawtimber, *or* 12 cords of under-sawlog-size, *or* 640 seedlings under 1 inch in diameter at breast height.
2. *Piedmont.* Seven thousand board feet of sawtimber, *or* 10 cords of under-sawlog-size *or* 640 seedlings under 1 inch in diameter at breast height.
3. *Mountains.* Five thousand board feet of sawtimber, *or* 8 cords of under-sawlog size *or* 640 seedlings under 1 inch in diameter at breast height. Here, hardwoods will make up most of the volume.

As reproduction diameters include the 4 inch tree class, 480 trees in the 2 inch class *or* 320 trees in the 4 inch class constituted full stocking.

Any one acre of forest land may be fully or partially stocked with one or a combination of the above mentioned conditions. If the acre does not support satisfactory stocking on the basis of the set standards, the percentage difference is designated as non-stocked. Reasons are sought for the non-stocked condition. For example, consider an acre plot in the Northern Coastal Plain that has been tallied and the volume determined. The estimator finds 2 M bd. ft. of sawtimber, 3 cords of under-sawlog size, and 160 seedlings. On the basis of the above standards the acre is 25 per cent stocked with sawtimber, 25 per cent under-sawlog-size, and 25 per cent reproduction, while 25 per cent of the area is non-stocked. This acre does not have enough trees to be satisfactorily stocked.

It is suggested that an ideal stocking, based on the proper distribution of size classes, would be to have 66⅔

percent of the area occupied by sawtimber and under-sawtimber size, and 33⅓ percent of the area occupied by reproduction. Non-stocked areas would be at a minimum. An examination of Table 16 will give the reader an idea of the approximate conditions as they exist in the sample counties.

Individual sample counties, within the same region and between regions, show a wide variation in degree of stocking. In the North Coastal Plain, Bertie County has 71 per cent stocking in the sawtimber and under-sawtimber size. This is probably due to the presence of a large amount of over-mature hardwood timber in the river swamp type and to the fact that timber cutting in the 10 inch-14 inch diameters (D.B.H.) classes has not been as heavy as in other sample counties in this region.

Pender County, in the Southern Coastal Plain, may be used to illustrate the opposite condition. This county shows 30 per cent stocking in the sawtimber and under-sawtimber size. Heavy cutting for logs and pulpwood, and lack of pine reseeding, is responsible for this condition.

Development of regional and state totals, from data obtained in the sample counties, is shown in Table 17.

An examination of Table 17 will show that the worst stocking conditions are found in the South Coastal Plain. The understocked condition in this region is due substantially to lack of pine seed trees and the prevalence of unrestricted fire. It should be borne in mind that if there is no pine on a large proportion of the forest land in the Coastal Plain, there will be nothing there but scrubby hardwoods.

Table 16.
ESTIMATED DEGREE OF SATISFACTORY STOCKING AS DETERMINED FOR THE 21 SAMPLE COUNTIES IN PER CENT

County	Commercial Forest Acres	Degree of Satisfactory Stocking			Degree of Non-Stocking
		Sawtimber and Under-Sawlog	Reproduction	Total	
NORTHERN COASTAL PLAIN					
Beaufort	363,779	44.2	31.8	76.0	24.0
Bertie	306,916	71.4	20.1	91.5	8.5
Currituck	80,022	50.0	21.2	71.2	28.8
Halifax	239,357	48.2	34.3	82.5	17.5
Tyrrell	213,481	43.8	39.4	83.2	16.8
SOUTHERN COASTAL PLAIN					
Bladen	424,795	38.7	28.2	66.9	33.1
Harnett	238,134	39.7	26.4	66.1	32.9
Jones	231,931	38.9	35.5	74.4	25.6
Pender	465,111	30.6	34.2	64.8	35.2
Richmond	191,411	40.6	22.8	63.4	36.6
Wayne	175,824	46.8	33.8	80.6	19.4
PIEDMONT					
Caswell	152,842	45.7	36.9	82.1	17.9
Gaston	85,233	52.0	31.3	83.3	16.7
Randolph	303,483	55.0	26.0	81.0	19.0
Wake	306,320	68.3	21.9	90.2	9.8
Yadkin	94,122	60.8	27.2	88.0	12.0
MOUNTAINS					
Ashe	90,138	39.8	29.2	69.0	31.0
Buncombe	271,632	66.0	16.0	82.0	18.0
Caldwell	220,551	61.5	23.6	85.1	14.9
Graham	169,100	61.0	25.0	86.0	14.0
Jackson	252,724	35.0	36.0	71.0	29.0

Table 17
ESTIMATED DEGREE OF SATISFACTORY STOCKING ON REGIONAL BASIS

Region	Total Commercial Forest Acreage of Region	Degree of Satisfactory Stocking in Per Cent		Degree of Non-stocking Per Cent
		Sawtimber and Under-sawlog Size	Reproduction	
North Coastal Plain	4,140,752	52.2	30.0	17.8
South Coastal Plain	5,607,685	37.7	30.5	31.8
Piedmont	5,039,742	58.2	26.9	14.9
Mountain	3,748,679	54.0	25.4	20.6
State	18,536,358	49.9	28.3	21.8

NON-STOCKING

Table 17 shows that 21.8 per cent of North Carolina's forest area is non-productive at present. In other words, approximately four million acres of forest lands are contributing nothing in the way of wood production to the economy of the state.

What is the reason for this condition? The consultants endeavored to answer the problem by determining the main reason for non-stocking on each of the non-stocked plots.

The following code was used to designate the reason for non-stocking:

A. Obstruction by culls and scrubs of cordwood size or larger.
B. Obstruction by advance reproduction of non-timber species.
C. Obstruction by low ground cover of vines and bushes.
D. Pine seed trees lacking—site too poor for hardwoods.
E. Recently cut area.
F. Effects of fire.
G. Incompletely seeded old field.
H. Seed trees present, ground not obstructed, reason for non-stocking not apparent.
I. Site too poor to support full stocking.

Obviously, some of these items overlap. For example, if pine seed trees had been present, seedlings might have received an early start and climbed out of the "C" obstruction before it became so dense.

Tabular results of the findings are recorded in Table 18.

Table 18

Region	A	B	C	D	E	F	G	H	I
North Coastal Plain ..	35	22	8	7	16	41	..	1	..
South Coastal Plain ..	37	31	21	67	11	47	1	6	..
Piedmont	39	41	8	4	24	2	6	6	9
Mountain	17	43	..	5	3	..	3	1	5
Total	128	137	37	83	54	90	10	14	14

One other question was asked concerning each non-stocked plot. "Will this area restock naturally in the next 10 years if not burned?" In 20 per cent of the cases the question was answered in the affirmative. Such non-stocked areas expected to reseed were largely of fire origin (10 per cent) and from effects of recent cuttings (6 per cent). If all woodlands could be protected, one might expect approximately 800,000 of the 4 million non-stocked acres to come back into production in 10 years without assistance. This, of course, is an unrealistic expectation. Actually, there are approximately 3,200,000 acres of "idle" forest land to "have and to hold" until changes are made in utilization or cutting practices.

Obstructions, as identified by code letters A, B, and C are responsible for 53 per cent of the non-stocking. Present cutting practices will tend to increase this percentage as pine stands are cut and as more marketable hardwoods are removed from the hardwood areas. Cull material will increase because it is being left after each "selective cut" (i.e., select the best and leave the worst). With complete exclusion of fire, hardwood bushes, especially in the Coastal Plain, increase to a point where pine seedlings cannot compete and will disappear from the stand. Hardwood reproduction of timber producing species may also be checked by the complete cover of non-timber producing shrubs and small trees.

Regulation of cutting practices is not the answer to this problem. Regulation cannot force the cutting of culls and shrubs and, until markets are developed for such material, it will tend to accumulate in the forests. Regulation can require the leaving of pine seed trees. This will, in some cases, establish pine seedlings quickly after cutting, thereby enabling some pine to become established before the brush takes over the area.

Complete exclusion of fire will not solve the problem, as most of the pine stands in the Coastal Plain are a direct result of fire in the past. Fires killed the bushes and exposed the soil thus preparing a bed for the pine seed. Fires seldom killed the large pines.

The problem of obstruction is one which will need some very pertinent research to solve. The answer may be found

TIMBER CUTTINGS THAT REMOVED THE SOURCES OF PINE SEED

Bladen County. Professor Slocum stands by the stump of a pine that should have been left. No other tree on 10 acres here could serve as a seed tree. Fire is a threat on this area.

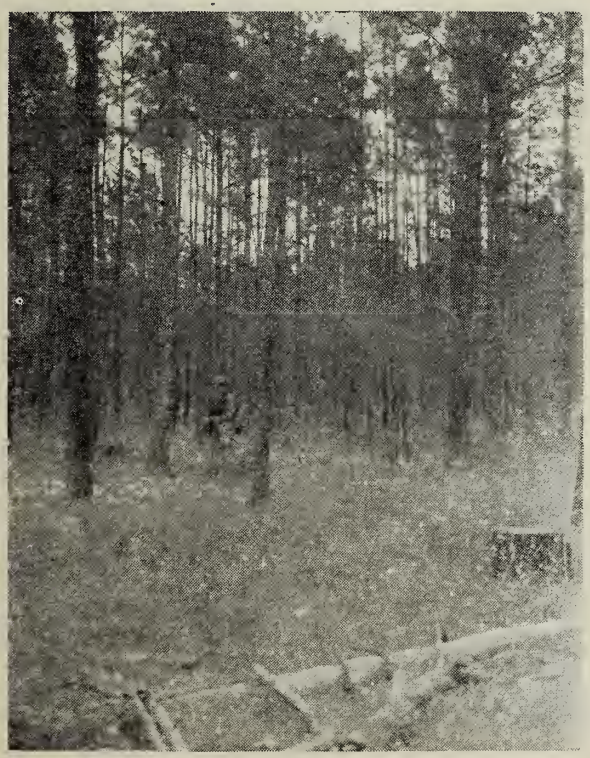
Pender County. None of these saplings can produce seed for years. This view exemplifies the tremendous waste due to nonproducing lands in North Carolina.

with the aid of an axe, a fire, or a goat. First, of course, there is need of more complete cutting which leaves no culls, or low-grade, or defective small trees containing sound wood.

Fifteen per cent of non-stocking on pine lands was traced primarily to the absence of a pine seed source. This problem could be helped by regulatory action. Where present, a source of pine seed must be retained if owners are to continue to grow pine on large areas of this state. Present trends show closer cutting of pine, as any one can see by looking at the log trucks that roll by on the highway. A "seed tree law" that can be easily interpreted and fairly enforced would retain a source of pine seed for future crops.

CAN PINE STANDS BE REGENERATED?

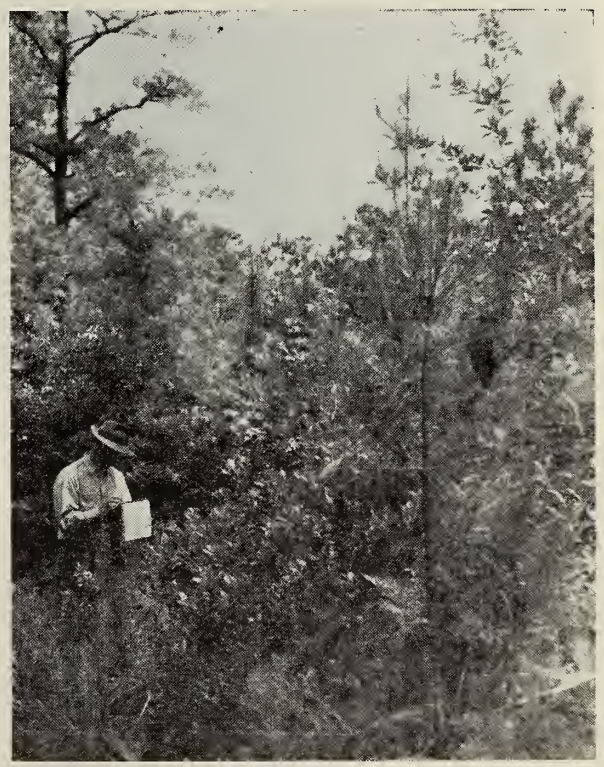
7. Pine reproduction can be obtained here in abundance. Frequent burning has continually killed back the hardwood sprouts. The ground is exposed to the extent that pines will "catch." There are already a fair number of very young pine seedlings present, grown up since the last fire. Fires will have to be kept out if the seedlings are to develop. The timber has been burned more often and harder than would be necessary to keep down the hardwoods. Johnston County.



8. It will be possible to obtain good pine reproduction here when a cutting is made in this loblolly pine stand. Fires have kept the hardwood understory completely cleaned out. Some very hot fires have passed over this land with the result that pine trunks are charred to a height of 20 feet. Some smaller pines have been killed. Lands of a pulp company in Northern Coastal Plain.

EXAMPLES OF HIGHLY SUCCESSFUL PINE REGENERATION

9. A fairly heavy stand of pine was cut on this area several years ago. Prior to the time the sawtimber was cut, occasional fires had kept down the hardwood growth. Sources of pine seed remained after cutting and the area quickly reseeded. The saplings are now growing vigorously. By a "fortunate accident" no fires have occurred since the cutting. A fire in pines of this size would be ruinous. Jones County.



10. This area is located many miles from the one pictured above, but has had a similar history. There were occasional fires before the pine sawtimber was cut, which kept down the hardwood growth. Pine seed trees were left. The area reseeded thickly to loblolly pine immediately following the cutting. Fortunately, no fires have occurred since the reproduction was established. Hardwood growth is coming up with the pines, but the pines will outgrow it and not be handicapped. Jones County.

Non-stocking due to prevalence of fire was limited mainly to the Northern and Southern Coastal Plain. Sixteen per cent of the non-stocking was due to this cause. Annual burning, in many sections of the two regions, has eliminated both pine and hardwood reproduction from large areas. A seed source is often present, but the areas cannot become stocked until adequate protection becomes a reality.

REPRODUCTION

It has been shown that 28.3 per cent of the stocking in North Carolina is reproduction. What is the proportion of pine and hardwood in this class of trees under 5 inches d.b.h.? Table 19 shows these proportions for the 21 sample counties.

Reference to Table 11 will show that the present stand of under-sawlog size material in the North Coastal Plain is composed of approximately the same proportion of pine and hardwood as was present in 1938; the South Coastal Plain has a gain in the proportion of pine; the Piedmont has a gain in the proportion of pine; the Mountains retain practically the same proportion of both. Recruitment of this material into sawlog size will give substantial stands of pine for the next cut. A study of under-sawlog-size only would cause no alarm over the so-called "hardwood encroachment."

However, a study of the reproduction that will replace the present under-sawlog-size in the next cycle, presents an entirely different picture. A comparison of present under-sawlog-size pine-hardwood proportions, with present proportions of pine-hardwood reproduction, is shown in Table 20.

Table 19

RELATIVE PROPORTIONS OF PINE AND HARDWOOD REPRODUCTION IN 21 SAMPLE COUNTIES

County	Per Cent Pine	Per Cent Hardwood
NORTHERN COASTAL PLAIN		
Beaufort	25.0	75.0
Bertie	20.5	79.5
Currituck	8.8	91.2
Halifax	16.1	83.9
Tyrrell	28.7	71.3
Regional Average	22.0	78.0
SOUTHERN COASTAL PLAIN		
Bladen	48.7	51.3
Harnett	25.9	74.1
Jones	51.4	48.6
Pender	64.1	35.9
Richmond	43.2	56.8
Wayne	37.2	62.8
Regional Average	49.3	50.7
PIEDMONT		
Caswell	32.0	68.0
Gaston	23.0	77.0
Randolph	18.6	81.4
Wake	34.5	65.5
Yadkin	38.7	61.3
Regional Average	28.3	71.7
MOUNTAINS		
Ashe	8.0	92.0
Buncombe	18.0	82.0
Caldwell	21.0	79.0
Graham	5.0	95.0
Jackson	11.0	89.0
Regional Average	12.9	87.1

Table 20

PROPORTION OF PINE AND HARDWOOD 6"-8" CLASS VS. REPRODUCTION

(Based on Tree Numbers in Both Cases.)

Region	Under-Sawlog-Size Trees % Pine (6"-8")	% Hardwoods (6"-8")	Reproduction-Size Trees % Pine	% Hardwoods
N. C. Plain	51	49	22	78
S. C. Plain	71	29	49	51
Piedmont	68	32	28	72
Mountains	23	77	13	87

The percentage figures in Table 20 were derived from total numbers of tree stems in each category. In the Northern Coastal Plain, present under-sawlog-size material is composed of 51 per cent pine and 49 per cent hardwood. This trend is not out of proportion considering the large percentage of swamp and river-bottom type in this region. However, with only 22 per cent pine reproduction growing to replace the present under-sawlog-size, the trend is definitely in favor of the hardwood.

The Southern Coastal Plain, with 71 per cent pine and 29 per cent hardwood in the under-sawlog-size, and 49 per cent pine and 51 per cent hardwood reproduction, reflects the effects of continued burning. If the present rate of woods burning is continued, the trend will be toward a reduction of hardwood stems and a corresponding increase in pine in the larger classes. However, stands of pine will continue to remain light if uncontrolled fire continues.

The Piedmont presents the most serious condition in reference to future pine stands. Present high pine ratios in the under-sawlog-size are a definite reflection of land clearing and abandonment. There are thousands of acres of bandoned old fields supporting fine stands of young pine in this region today. The trend, at present, is toward land stabilization and when lands do become stable, the day of the "old field pine" will end.

Present under-sawlog-size is made up of 68 per cent pine and 32 per cent hardwood while the reproduction is 28 per cent pine and 72 per cent hardwood. Most of reproduction size is, of course, in abandoned fields too.

The Mountain region is primarily a hardwood region and, thus, causes no concern.

It can be seen that pine reproduction is fighting a losing battle in all sections of the state. Present cutting methods tend to increase the odds against the pine. Even conventional silvicultural methods of cutting such as the selection, shelterwood, and seed tree methods do not insure reproduction of the pine species. In fact, they aid in the re-

production of the various hardwood species by removing the overstory of pine. This merely hastens the approach to Nature's goal of establishing a hardwood climax forest. As most of our pine forests developed as a result of disturbing Nature's process by land clearing or fire, what are foresters going to do to keep North Carolina's pine lands—estimated to be at least ⅔ of the forest area of the state—producing pine in the next 50 or 100 years? Will the problem be solved by forgetting pine and concentrating on the development of bulkwood industries to use the tremendous volume of hardwood that is usable for no other purpose at present except fuel?

If so, the forests will be able to support only about one-half of the bulk-wood industry, or ⅓ of the lumber industry that would be possible with pine.

CAUSES OF FIRE

Figures supplied by the N. C. Forest Service show the following causes of forest fires on State-protected areas in the order of their incidence. The figures shown are the annual average as determined for the calendar years 1940 to 1944, inclusive.

1. Smokers	1212
2. Incendiary	851
3. Debris burning	792
4. Hunters, fishermen, campers	419
5. Miscellaneous	338
6. Railroads	193
7. Lumbering	98
8. Lightning	34
Total, all causes	3937

The above figures show the number of fires by various causes for cooperating counties only. For the fiscal year 1945-46 there are 63 counties cooperating. Only estimates are available for the non-cooperating counties.

What about the personal element involved in most fires? Human carelessness and lack of responsibility and, in some cases, local customs, are the main issues.

Many forest fires develop while individuals are engaged in burning tobacco beds, ditch banks, hedgerows, broom straw fields and pasture. Responsibility for fires of this type is generally not hard to establish when experienced men are used to collect evidence. Once responsibility is established, the proper action can (and should) be taken.

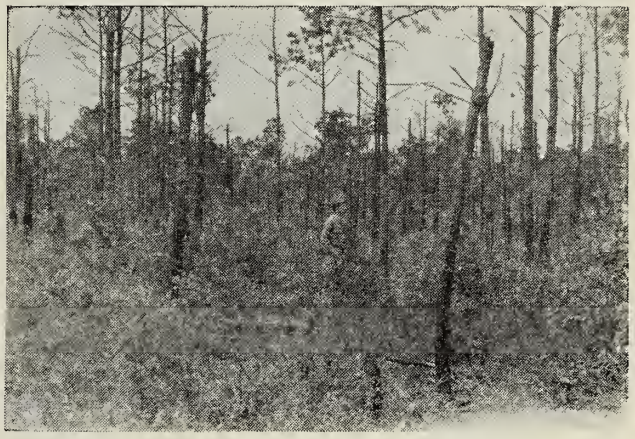
Fire law enforcement, it should be said, is an important part of the work of the Division of Forestry and Parks. In fact, the Division's law enforcement record has been for some years the best among forestry agencies in the South. This program, like many others, has suffered during the war years due to drastic loss of supervisory personnel. In 1940, as a sample pre-war year, the Division handled 4,726 fires and 445 fire law prosecutions (of which 397 resulted in court convictions). An *additional* 424 cases were settled for payment of the fire-fighting costs by the responsible parties.

Hunters are responsible for many fires by failure to extinguish warming fires and by trying to smoke squirrels, o'possums, raccoons, or bees from hollow trees. Local deer hunters often take it upon themselves to improve hunting by eliminating underbrush. Some areas, it seems, have to be "swinged off" periodically so that hunters can see to shoot! Ownership of land does not concern them, neither does the crop of trees present on the area.

Others burn to "kill boll weevils" or "ticks and snakes" and "to chase the bears back in the swamp so they won't eat the corn or 'chillun' ". Education may convince some of these people that burning does not accomplish their purpose. Habitual woods-burners will have to be "lawed until they see the light."

FIRES RAVAGE EASTERN N. C. WOODLANDS

11. Farm tenants who live near this big woods area in Jones County are apparently responsible for fires sweeping across it nearly every year. There are some good pine seed trees and the area could reseed to pine if burning could be stopped. Th ground is in good shape for pines to become established.



12. The owner of this formerly dense young loblolly stand in Bertie County has sustained a heavy financial loss due to fire. The majority of the pines were killed.

EXTENT OF BURNING

A study of Table 21 will show that woods burning is also a regional problem. Present fire detection and suppression methods appear to be satisfactory in the Piedmont and Mountain Region, but are inadequate in the Northern and Southern Coastal Plain. The figures listed under acreage burned have been determined by field sampling and do not necessarily check with other published acreage figures. However, the sampling method used gives a very good indication of actual burned acreage.

Wake County may be used as an example of procedure. Seventy-four one-quarter acre plots were mechanically selected for study. The plots were carefully checked to determine if burning had taken place within one or five years, this information being obtained from the age of

sprouts on fire killed hardwoods. The one source of error incurred is that it is impossible to tell if sprouts five years old were killed by a fall fire in the sixth year, or by a spring fire in the fifth year. This error is more than balanced, however, by the fact that many areas have burned more than once in the five-year period.

It was thus determined for Wake County that 2.8 per cent of the plots or 8,675 acres were burned in the current year, while 11.4 per cent or 35,313 acres were burned in the five-year period. The average annual burn in this county for the five-year period was 2.3 per cent or 7,064 acres.

Table 22 was developed from the average burned acreage figures of the sample counties. The development of this table presupposes that the sample counties contained representative conditions in each region.

OVERWHELMING FIRE PROBLEM IN EASTERN NORTH CAROLINA

On the coastal side of the Northern and Southern Coastal Plains there is a strip, approximately 75 miles wide from Virginia to South Carolina, that features conditions not to be found on such a large scale anywhere else in the United States. There are about 25 counties lying in this area. This coastal region is typified by flat land, sand ridges, pocosins, bays, and swamps.

The fire situation in this region is one that will need more money, trained men, and research to control. The present fire protection system is quite inadequate and cannot possibly solve the problem, which arises from the inflammability and rapid growth of vegetation; peaty and inflammable nature of much of the soil in time of drouth; large unbroken forests tracts; and attitude of the people.

Table 21

ESTIMATED ACREAGE AND PER CENT OF FOREST LAND BURNED IN 21 SAMPLE COUNTIES FOR ONE-YEAR AND FIVE-YEAR PERIODS.

County	Gross Forest Acreage	% Burned 1 Year	Acreage Burned	% Burned 5 Years	Acreage Burned	Av. Annual Burn—%	Av. Annual Burn—Acreage
NORTHERN COASTAL PLAIN							
Beaufort	363,779	16.7	60,751	53.3	193,894	10.7	38,779
Bertie	306,916	4.1	12,584	29.3	89,926	5.9	17,985
Currituck	80,022	3.2	2,560	13.8	11,040	2.8	2,208
Halifax	239,357	8.6	20,585	17.7	42,605	3.6	8,521
Tyrrell	213,481	7.5	16,011	55.3	118,055	11.1	23,611
SOUTHERN COASTAL PLAIN							
Bladen	425,295	11.9	50,610	36.1	153,532	7.2	30,706
Harnett	238,134	13.9	33,100	49.1	116,924	9.8	23,385
Jones	231,931	27.6	64,013	58.0	134,520	11.7	26,904
Pender	465,111	38.3	178,138	67.0	311,624	13.4	62,325
Richmond	191,411	7.4	14,164	30.4	58,189	6.1	11,638
Wayne	175,824	6.0	10,549	21.1	37,099	4.2	7,420
PIEDMONT							
Caswell	152,842	*		1.7	2,958	.3	519
Gaston	85,233	*		14.6	12,444	2.9	2,489
Randolph	303,483	*		7.5	22,761	1.5	4,552
Wake	309,820	2.8	8,675	11.4	35,319	2.3	7,064
Yadkin	94,122	*		.0	*	*	*
MOUNTAINS							
Ashe	91,276	*		4.0	3,651	.8	730
Buncombe	273,284	*		3.0	8,198	.6	1,640
Caldwell	220,559	*		*	*	*	*
Graham	172,900	*		*	*	*	*
Jackson	253,252	*		*	*	*	*

* Some burning present, did not encounter any on sample plots dis-tributed in all sections of county.

Table 22

ESTIMATED REGIONAL BURN BASED ON 5-YEAR PERIOD PRECEDING THE APPRAISAL.

Region	Gross Acreage Forest Land	Total Burn 5 Yrs. %	Total Acreage Burned 5 Yrs.	% Burn 1 Yr.	Average Annual Acreage Burned
North Coastal Plain	4,140,752	37.8	1,565,204	7.6	313,040
South Coastal Plain	5,607,685	47.0	2,635,612	9.4	527,122
Piedmont	5,050,152	7.7	388,862	1.5	77,772
Mountains	3,998,656	1.2	47,984	.2	9,597
State Totals	18,797,245	24.8	4,669,338	4.9	927,521

The vegetation of this region consists of wire grass and scrubby oaks on the drier places and a mixture of pepperbush, gallberries, various bays, swamp ironwood, reeds, and huckleberries on the more moist sites.

The soil is low in calcium and, as a result, the vegetation has a very high fiber content in the leaves. This high fiber content and rapid growth plus the oils and resin typical of the above species, creates annually a head-high mass of highly inflammable material. It quickly dries, even after a downpour, and some claim that the only time during the year that a fire season is absent is when it is raining. As a result, late spring and summer fires burn with great heat and cause a tremendous amount of damage.

The large, unbroken and, in many cases, seemingly impenetrable tracts of forest land present their own special set of conditions. Agricultual land developments follow the county road systems and the forest land tends to be in large blocks at the center of these highway-surrounded sections. The forest land holdings of many owners thus come together and form large unbroken tracts. There are also many large forest tracts owned by individuals, lumber companies, and corporations having no connection with agricultural land.

Indiscriminate backfiring of whole blocks of timber in self-protection may have pathetic results as in one case in Bladen County. The incident was described by a local farmer who had assisted in fighting the so-called "backfire." He said, "We found one old Negro woman with two crazy daughters holding three scared cows on a little grass island in the timbers. The fire and smoke were 'biling' up into the elements while they screamed and bellowed in fright."

This fire burned over one ownership of 5,000 acres that was surrounded by small farms. When the fire started a crew attacked the fire, but adjoining owners immediately "protected" their property by backfiring. As a result the whole area burned.

County agents, U. S. Soil Conservation Service technicians, foresters, lumbermen, and farmers were almost unanimous in their opinion that the fire situation could not be greatly improved until these areas are opened up so that a fire crew can get near the fire and shut it off in a small space, instead of backfiring around the whole area.

The Division of Forestry and Parks believes that a strong program of pre-suppression fire line flowing, with landowners directly sharing the cost, offers the best single answer to this problem of accessibility. Such a program is being pushed as rapidly as funds for the necessary heavy equipment become available.

Attitudes of people concerning woods burning vary widely. One group, consisting mainly of landowners who own timberland, is growing more conscious of the damage done by fire and is interested in preventive measures. However, many of them are against complete exclusion of fire and want winter-burning of their lands as an insurance measure against a late spring or early summer "wild" fire. Some contend that "fires are worse since the warden program started." They base their contention on the fact that where forests are protected for a period of 6-10 years and then an accidental fire burns over the area, the accumulation of litter is such as to cause an almost complete loss of trees even 16"-20" in diameter. The landowners contend that it is far better to have a slight loss from a winter fire than a complete loss from a late spring or early summer fire.

Some landowners are still convinced that winter burning is the best insurance against hot spring fires. A definite action program will be necessary to convince them that they can be adequately protected from "wild" fire.

What is the attitude of the group consisting of tenant farmers, sportsmen and others who are in and around the woods, but don't own it? Too often their attitude is one of unconcern. Many are not concerned about the future of any area and are interested mainly in their own ideas and pleasures. It is from this group that the lands of the first group must be protected. Intensive education and enforcement work would be of benefit in dealing with these people.

In spite of education, enforcement, or other proposals, there will still be forest fires. Always there are the activities of irresponsible persons and the effects of accidents; otherwise, neither police forces nor insurance companies would be needed. To cope with the situation in Eastern North Carolina, the landowners must have outside assistance in suppression work. Outside assistance must be furnished in the form of trained fire fighting personnel, additional fire towers, and heavy equipment such as tractors and fire line plows and pumpers, furnished by the State. In addition, the landowner must expend more of his own money for maintaining fire breaks. The county and state cannot be expected to protect fully the individual. He must bear his own share of the cost of producing his crop of timber.

STATE-WIDE FIRE CONTROL

North Carolina does not have a state-wide fire control budget or organization. Each county makes the decision as to whether it will take part in fire control work. Cooperating counties, through the County Commissioners, appropriate money which is matched by state and federal funds. In the fiscal year 1945-46 there were 63 cooperating counties which appropriated $105,650. The state appropriation was $187,189; the federal, $164,720. The total budget was $469,517. With 12,440,000 acres of forest land under protection, the average allotment was about 3.7 cents per acre. Approximately 4,500,000 acres of forest land are unprotected by organized fire fighting crews.

It is a well-known fact that present appropriations are not adequate to handle the situation. More money for expansion is sorely needed if the state is to help solve a very trying problem. Lack of fire control has been one of the main drawbacks to many forestry developments in this state. It has been one of the principal reasons given by lumber companies for not acquiring land and endeavoring to grow some of their own timber. Fire frequency has also been the reason for lack of interest in tree planting on large unstocked areas. One farmer in the eastern section planted several thousand trees early in the spring and lost them to fire before they started to grow.

What can be done to make the fire protection and suppression system more effective in this state? The answer may be found in adequate state-wide control.

W. K. Beichler, State Forester of North Carolina, is working on a state plan to present to the 1947 Legislature. It is recognized that fire hazards are variable in the different regions of the state and the proposed plan classifies these regions accordingly. As much as 16 cents an

acre per year is recommended for prevention and suppression work in the Coastal "ground-burning" counties with their large unbroken tracts of timber land, as compared with 2 cents per acre in the well-broken forest areas of the Piedmont. With fire control on a state basis, effort can be concentrated where needed, from the Mountains to the Coast.

The timber resources of North Carolina are a state responsibility. As most of the wood-using industries depend upon the state as a source of raw material, fire control is not entirely a county problem. The method of financing a state-wide system must, of course, be determined by the General Assembly. Recommendations have been and will be made by the Department of Conservation and Development.

The neighboring states of Virginia and South Carolina have recognized the need of state-wide control and have established systems to meet their responsibilities.

CAN FOREST MANAGEMENT MAINTAIN PINE?

COMPARATIVE VALUE OF PINE AND HARDWOOD ON "PINE LAND"

This question has often been asked: Does pine or hardwood produce the greatest return, in volume or value, when grown on the so-called "pine land" in the Piedmont and Coastal Plain? An exact answer, based on research, has evidently not been found. However, most authorities agree that the volume produced by pine far exceeds the volume produced by hardwoods on the flat "pinelands" and rolling uplands. Dr. C. F. Korstian, Dean of the School of Forestry at Duke University, said: "It is my opinion that pine will produce at least two times the volume in the same period of time on approximately 80 per cent of the land in the Piedmont. The remaining 20 per cent of the land, which is located along stream bottoms and draws, is suited for good quality hardwood production."

G. M. Jemison, Silviculturist of the Southeastern Forest Experiment Station, believes that pine will outgrow hardwood two to one on at least 75 per cent of the land in the Piedmont, but stated he had no figures to prove it. Professor H. H. Chapman, of Yale University, dismissed the hardwoods on most of the lands in the belt along the eastern coast as "worthless brush" when compared with pine.

Assuming that pine will produce greater volume per acre on these areas, what is the comparative quality of the material produced? High quality hardwood logs have a greater value, financially, than pine. This being the case, is it better to grow hardwood than pine? The answer is definitely "No." In the first place, the volume production from pine more than offsets any financial gain from quality hardwoods and, in the second place, there is very little hardwood "quality" production on these areas.

If the present hardwood forests on the sand ridge, sandy loam, and rolling upland areas are any indication of the quality to be produced, the state can meet its full requirements for fuelwood, but not for lumber. The oak, hickory, maple, black gum and other hardwood species do not produce high, or even medium quality, lumber on these areas.

In an effort to ascertain what proportion of the forest lands in the Piedmont and Coastal Plain are better suited for the growing of pine than hardwood, plots were carefully examined and the conclusion reached was influenced by existing stands, drainage indicator plants, soil, and site index. From these field classifications, proportions were determined for each of the regions under question.

The North Coastal Plain shows approximately 40 per cent of the region better suited for pine than hardwood; the South Coastal Plain 72 per cent; and the Piedmont 78 per cent. In fact, one might express it more strongly and say that the above proportions of forest land are definitely unsuited for hardwood production, since they produce slow-growing, short-boled, defective trees suitable mainly for fuel.

Thus it is clear that pine in not being grown on those areas best suited to it. The hardwoods are moving into the pine areas just as Nature intended them to do. The rate at which the hardwoods are proceeding in this succession is fully discussed under "Reproduction."

NATURAL SUCCESSION

What is Nature's intent in the Piedmont and Coastal Plain? Natural succession may well start with a bare area such as an abandoned field or one exposed by fire. Ecologists point out, and any observer can see for himself, that the field is first occupied by low grasses such as crab grass. This is followed by the tall weed species and then by broom sedge. The broom sedge forms the perfect nurse for pine reproduction so that in six to ten years most old fields support a fine stand of young pine, if a seed source is nearby. Succession then slows down, the pine may mature with more or less interference from the hardwoods; but as the stand grows older and the pine trees die, one or several at a time, their place is not taken by pine seedlings, but by hardwoods. The hardwoods are more successful in forming an understory and can take over at the expense of the pine. Thus by the time the original pines have passed from the picture, the area is well-stocked with hardwood species that will later form the climatic climax typical of the region. This complete succession may take place naturally in less than 200 years.

This natural succession has been quite evident on lands owned by the Division of Forestry, N. C. State College. One 80-acre tract of virgin loblolly pine was in the last stages of pine supremacy before being cut. As individual pines died from natural causes their place was being taken by oaks and hickories.

Stands of Virginia pine show even more rapid deterioration when the trees are mature. Fully stocked stands on old fields may be regenerated, mature, and be displaced by hardwood in a period of 100 years.

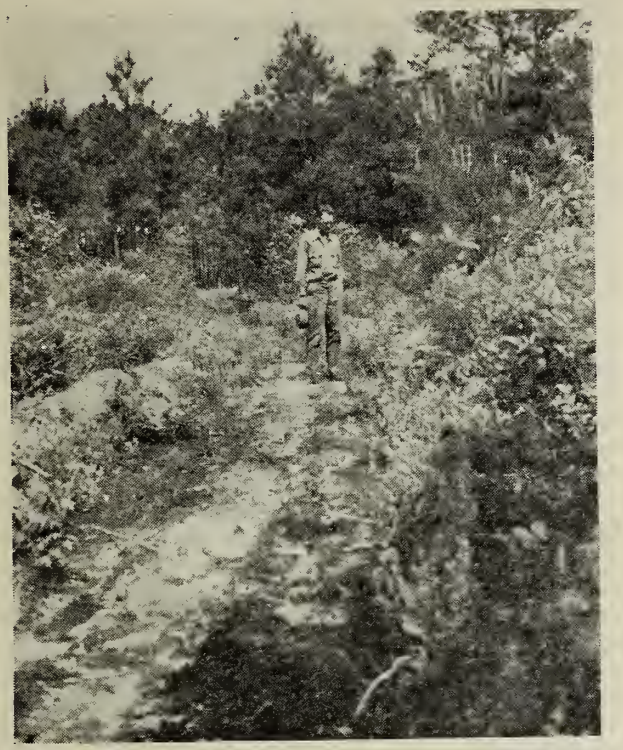
SOLUTION OF THE PROBLEM

It has been pointed out, elsewhere in this report, that present cutting methods tend to hasten this natural succession by removing the overstory of pine. If this is the case, what can be done to keep pine on these areas that are better suited for growing pine than hardwoods? With the present trend toward land stabilization and complete exclusion of fire, how can Nature's challenge be met and this natural succession halted?

Three recommendations are offered. Dr. C. F. Korstian, Dr. J. V. Hofman, Dr. H. H. Biswell, and others agree on the various points, but not necessarily in their application.

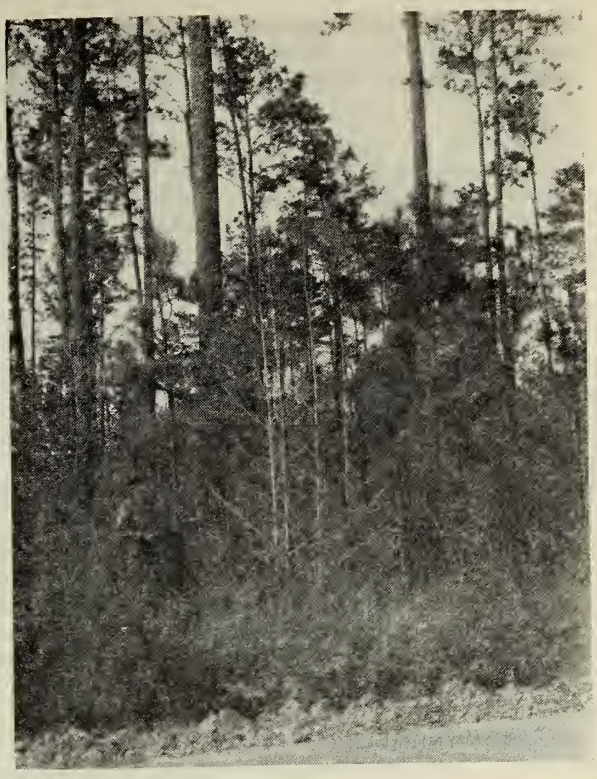
1. *Grazing.* It has been observed, and some research has

EXAMPLES OF EFFECTIVE FOREST MANAGEMENT



13. Fire lane on pulp company lands. Made with tractor and Mathis plow. Used to divide the property so fire can be reached and confined to small area by backfiring. Jones County.

14. Excellent thinning of immature old-field loblolly stand by farmer in Wake County. His product was tobacco wood.



15. Seed trees and some merchantable growing stock left after cutting on lumber company lands in Bertie County. The hardwood brush remains a serious bar to reseeding.

proved, that cattle grazing on forest lands in eastern North Carolina favors pine reproduction and also decreases the fire hazard by reducing the accumulation of litter. The direct effect of cattle is to remove many competing hardwoods by browsing and to trample pine seed into the ground so that the seed comes in contact with the mineral soil. It has been proved that grazing on forest lands is profitable under certain conditions and during specific seasons.

However, cattle grazing has its limitations. There is room for expansion in the cattle industry, but to increase the industry to a point where it would solve the problem in the Piedmont and Coastal Plain, would mean the use of such numbers that it would be impossible to feed the stock during the seasons when the forest areas would not support them.

Further research is definitely needed, especially in the Piedmont region. Dr. C. M. Kaufman, Associate Professor of Forest Research at N. C. State College, is now conducting a forest grazing study. No conclusions have been reached at this time, as to the effect on pine reproduction.

More information is needed as to the exact concentration of cattle per unit area to accomplish the desired results. Also, the use of sheep and goats may well be investigated, especially in cleaning tangled areas of brush, brambles, and vines.

2. *Cleanings.* The bush-axe is a fine silvicultural tool, but one that is not used frequently enough at present. Many forest areas could be put back into volume production by the removal of brush and sprouts that are suppressing the pine seedlings already present on the area.

Landowners could well utilize idle farm labor during winter months for this purpose. It is possible to clean several acres per man-day even in very brushy areas. Winter is the best time for this work as the brush is more easily cut and handled when the leaves are absent.

This system is very effective where reproduction is present, but cannot be recommended as a method of aiding the re-establishment of pine by natural seeding when the area is completely occupied by shrubs and bushes. More drastic exposure of the mineral soil is needed when the above condition exists.

3. *Fire.* The use of fire, *fire that is expertly controlled as to time, place, and size,* is one of the most valuable silvicultural aids. Observations in the field, plus collateral reading, indicate that the use of controlled fire is not only desirable, but necessary if pine is to be retained as a commercial crop in the Piedmont and Coastal Plain.

Several points must also be made quite clear before proceeding with a discussion of the use of fire.

1. The present fire control system must be strengthened, especially in the Coastal Plain, so that "wild" fire can be controlled. This point cannot be overemphasized. Adequate and continuing control of wild fire is absolutely essential before a program of controlled fire can be initiated.
2. Present fire protection educational efforts should be changed to a program that admits the intelligent use of fire as a silvicultural tool, while decrying the damage done by fire. Modify the present approach to the subject and present scientific facts. The N. C. Division of Forestry and Parks is already using this new approach on a trial basis. Many landowners have seen the beneficial effects of light accidental fires on the establishment of pine reproduction and have begun to wonder if foresters know what they are talking about. If foresters lose the confidence of landowners, any program will fail.
3. All hardwood sites must be excluded from such discussion. Good hardwood producing areas must have fire exclusion at all times.
4. Last, but not least, it is reasonable to assume that the landowner, and those who come in contact with the woods, will not use the idea of controlled burning as an excuse to burn up the state. A burning permit system, liability laws, and enforcement control are still in effect to take care of the irresponsible person. If landowners are shown the value of their timber, both present and future, on a cash basis, they will not willfully destroy their assets. Timber values are not yet known to many landowners, as evidenced by their method of "lump sale" and the destructive cutting allowed on their property. More education of a practical nature is sorely needed.

What is the reason for wanting to use controlled fire in the first place? How did the pine stands in the Piedmont and Coastal Plain originate? The answer to the latter question is land abandonment in the Piedmont and fire in the Coastal Plain. The fine stands of longleaf pine that were found in the Coastal Plain by early settlers were the result of fire. Dr. B. W. Wells, Head of the Botany Department, N. C. State College, in referring to the Southeastern Coastal Plain, states: "So universal is fire in the area that mature climatic climax communities are unknown. All evidence indicates that the extensive pine forests are fire sub-climaxes. The hypothetical suggestion offered for the upland climaxes is a dry oak one for the deep, coarse sand; moist oak-hickory on the finer sand textures; with beech-maple on the moist slope bases. On more moist sites, but locations not wet enough to carry swamp forest, a characteristic community of red bay, sweet gum, red maple and sweet bay may be expected."

If uncontrolled fire in the past was a factor in the development of fine stands of pine over large areas, it is quite reasonable to suppose that even better stands could be evolved when fire is used as a tool, intelligently applied.

Lack of research in the Piedmont and Coastal Plain of North Carolina is a definite handicap at present. The solution of this problem should be undertaken as soon as possible and definite burning procedures established for the various topographic types. Rolling uplands, sand hills, flat woods, bays and pocosins should receive separate study as no one set of standards will apply for all conditions. It may be found that bays and pocosins should be excluded from burning altogether.

Some few experimental burnings have been made, but have been quite limited in their extent. Carl G. Krueger, Forest Supervisor, Pisgah-Croatan National Forests, states: "Some prescribed burning was carried out on the Croatan district in 1942. The burning was carefully done, but was on a very small scale. No cost figures were kept. Heavy fire damage from wildfire, that same spring, largely nullified some of the work, since some of the areas were covered or surrounded by wildfire. Results on these areas where identity could be maintained were fairly good. The rough was reduced markedly, percentage of brown spot on young longleaf pine was reduced, and a good catch of seedlings has been obtained. Our burning has been confined to the longleaf pine type as fire should be excluded from the pocosins or loblolly pine sites."

Not only does prescribed burning benefit long-leaf pine, but when properly used, burning may accomplish the desired results with loblolly pine as well. Professor H. H. Chapman, School of Forestry, Yale University, has shown that fire can be used to advantage in loblolly pine stands in Arkansas and West Louisiana, and has made specific recommendations for its use on certain industrial forest areas in North Carolina. If these recommendations are carried out, the results will be most interesting to all concerned.

It is not possible to make definite statements on controlled burning procedures in this state. Procedures developed in other sections might well apply here, either in modified form or in the same form. Men must be trained to carry out any controlled burning program, or it will fail from the start. Many an owner in the Deep South has too quickly assumed that controlled burning was an easy matter, with the result that he burned up many dollars worth of timber.

REGULATION OF COMMERCIAL TIMBER CUTTING

The idea of regulating timber cutting has been talked about for many years in America. Proponents of regulation have been more vociferous in the last 10 years than in all preceding years. The U. S. Forest Service is clamoring for national regulatory legislation and seems to have

gained the support of many members of Congress. Legislatures in many of the important timber states have had the proposition before them in recent years. The majority have either felt that a particular measure was not the right one, or that there was not enough support for it at the time. A number of states are believed to have adopted timber-cutting regulations that will produce the results intended.

Any American attempt at regulation of timber-cutting is bound to be an experiment, at first. Imperfections and failures should be expected until it is learned what is needed and what will work in different parts of the United States. A state is not to be criticized if its first attempt is discovered to have weaknesses.

A great many landowners, timbermen, county officials, business leaders, agricultural workers, and foresters were questioned to learn what they think about public regulation of commercial timber-cuting in North Carolina. The idea of any rules to be enforced on forest landowners was dismissed, because there are over 200,000 of them in North Carolina, mostly farmers, and administration of rules involving various kinds of cutting by so many people would be simply too big a job for any agency that could be empowered to handle it. Rather, some kind of supervision of the cutting of trees or buying of logs by commercial operators was proposed. This would include sawmill men, pulpwood contractors and buyers of veneer logs, crossties, poles, and such commercial products as may be deemed necessary. This approach seems more practicable, as there are only about 3,000 of these commercial operators.

It was not assumed that regulation was needed. Information was sought from examination of woods conditions, and from informed sources, as well as from the general public.

CONSIDERABLE INTEREST IN REGULATION

The majority of those interviewed were in favor of "something being done about the timber cutting." From records of interviews, the following examples show the different kinds of opinion:

Soil Conservation Service Technician: "There is strong feeling in the county that something should be done to stop mills from coming in and cutting everything on a place."

County Commissioner and portable sawmill operator: "Rules about timber-cutting might be all right if they were enforced fairly, but I don't approve of government interfering with business. The woods do need to be laid off of awhile."

Deputy Sheriff and farmer; community leaders (Question by consultant) "Would people in this county support laws to stop close cutting of timber?" (Answer) "Yes, they would." (Question) "Sure they wouldn't yell about their rights? You know, people are complaining about so many regulations." (Answer) "Yes, understand that. But we've got to do something about our timber."

Tax Collector: "I don't know what should be done about timber-cutting."

Big Lumberman: "Against further regulations at this time. Might be interested later when something is worked out to reduce fires." (Note: This is a coastal county where fires are bad.)

Tobacco Farmer: "Need a government law to stop woods being murdered by lumber and pulp companies. It's a sight how they cut it close an' knock down what they don't cut. We need a law also to protect a feller from his tenants. Always want to cut the best trees. Leave if you get after them."

Medium Lumberman: "Regulation is needed." (Further conversation revealed his timber supply was being limited by pulp cutting. Possibly he felt regulation would slow down pulp cutting.)

Big Lumberman: "Educate. I don't think it is right for the state or federal government to tell a man which trees he may cut on land that he is supposed to own."

Veneer and Lumber Manufacturer: "We favor regulation."

The above are fair examples of opinions offered by farmers, lumbermen, landowners, and county leaders generally. Asked if their counties would show enough support to make it worth-while to try regulation, S. C. S. technicians were equally divided in opinion. In general, people whose activities would be little touched by timber-cutting regulations, such as farmers, businessmen, and the general public as represented by town and city people would favor regulations. These people believe in a general way that the woods are being hacked to pieces and that something should be done. Their ideas as to how timber ought to be cut, however, are just as likely to be wrong as right, because they don't know. Practically all of them would condemn clean, heavy cuting as destructive. Yet in many cases this might be good forestry.

Lumbermen are divided on the question. Generally, the portable sawmiller and the concentration yard man are against restrictions. The kind of cutting regulations almost everyone thinks of would require a considerable number of smaller trees to be left, and this would severely curtail the operations of many portable mills.

In discussing regulation, there was no attempt to discuss details as to how much would or would not be cut, nor to indicate the level of publication regulation—State or Federal.

The pulp mills appear willing to accept regulation; at least representatives of two large companies so indicated. They stipulated that it should be state regulation; they would oppose federal regulation. Pulp mills have been much criticized due to heavy cutting of small pines by contractors. One of the defense arguments is, "Why should we leave merchantable trees? The landowner may turn around and allow a 'peckerwood' sawmill to cut them all later." Sawmills use the same argument. No one cares to leave merchantable trees for the future, because it is claimed that some one else will get them.

The timber game does not have any rules or referees; anything goes. If this is resulting in damage to forest production, and it is feasible to do something about it, then the public does seem to have a duty in the matter. Apparently, most states are beginning to see it in that light, as regulatory proposals keep coming to the legislative bodies of timber states.

REGULATION WILL NOT BE SIMPLE

Early in the investigation, it was shown that people do not relaize just how complicated a set of forest cutting rules might be. Americans have a blind faith that a new law will correct almost any situation. In this case, the difficulties to be encountered should be understood in advance, so that proposals will be carefully considered.

Some county workers of the U. S. Soil Conservation Service, who do forestry work with landowners, seemed to understand the complications, as most foresters do who "stay in the woods." Thinking of this, one forester said, "When foresters move out of the woods to town, the answers are much simpler and more easily arrived at." Said one Soil Conservation worker near the coast, "Regulation might be desirable, but how can anything workable be developed here? There are so many different conditions. The rules would be full of loopholes."

In the woods, there often are situations where the needed measures would be hard to fit into general rules. It is somewhat discouraging to note that many people seem to overlook this feature.

The Southeastern Section of the Society of American Foresters appointed a committee to draft a set of cutting practice rules that would be a desirable minimum. The U. S. Forest Service has an outline also, somewhat similar. The average timber operator would not be able to interpret either of them and thereby guide his cutting to meet the standards. The rules are not unduly complicated, but there are too many conditions to be covered. The Society Committee stresses the fact that the rules are necessarily somewhat flexible and would be held up as a guide only where a forester or forestry-trained man was not in charge of the cutting. If the practices were under direction of a forester, the regulatory body would then pass on his system to see if it met the objectives of the law.

It is believed that these cutting rules would make it necessary for a forester to oversee all cuttings. They apply to both pines and hardwoods. They specify, for example, that certain desirable hardwoods should not be cut if under 17 inches at the stump; that good pine should not be cut if under 15 inches at the stump, unless numerous; that smaller pines should be left to the number of 80 per acre; and so on, with various conditions stated under which different specifications would apply, including clear-cutting.

The fact that these proposed rules envisage a forestry-trained individual planning and checking on commercial timber harvesting, should enable the objectives of a regulatory act to be met in any timber condition in a sensible manner. How to make available, or in other ways obtain the technical guidance that would be necessary is a matter concerning which few suggestions have been made to date. No doubt this could be worked out if enough support could be obtained for the plan.

Let no one suppose that timbermen are universally opposed to a thorough-going set-up, such as the one proposed. One lumber man said, "Each county should have its own forester, paid ½ by the state and ½ by the county. After the public is educated, give him a whip hand. 'Any timber sold in —— county, not in accordance with county forester's recommendation, should be subject to special tax of 5 per cent of the sales price." Another said, "Although we are snowed under by government regulations, we would be glad to comply with any laws enacted for the purpose of conserving and improving our timber resources."

RECOMMENDATIONS

The data obtained indicate that pine restocking is being damaged by cutting, and that it is desirable to consider regulatory action.

The discussion of the relative values of pine and hardwood growth in the section on Management explains the importance of using every feasible means to maintain pine in our forests. The section headed "Degree of Satisfactory Stocking" presents data showing the unmistakeable trend toward hardwoods on former pine lands.

Almost all timbermen think of regulation as a set of rules with considerably more complications and prohibitions than those believed necessary to reserve pine seed sources. There were a number of opinions given as indicating that seed tree regulation might be widely acceptable. It would be argued that merely leaving seed trees will not insure pine reproduction. That is true in many cases. But, at least, a source of seed will be preserved so that the owner will have something with which to work.

Seed trees would be a great benefit in Coastal forest areas where frequent fires kill back the hardwoods. As it is, with fires killing the hardwoods, and pine seed sources being removed, such areas are doomed.

The data does not indicate urgent need now for rules applying to hardwood cutting. Hardwood sawtimber is not decreasing, and cordwood-size material is increasing.

If a regulatory plan which put a forestry-trained person on the ground to plan or to approve cuttings could be adopted, that would take care of the situation described. However, in the event the more complete plan cannot be put into practice, it is felt that seed tree legislation might well be considered by itself.

This point should be stressed. No legislation is likely to have success in the United States unless a majority of those to be affected support it. Nothing can be accomplished unless enough sawmill and pulp men will themselves put their influence behind a plan.

TAX SITUATION ON FOREST LAND

It has been stated by some individuals and companies that the high tax rate on forest land is one of the drawbacks to their practice of forestry. They state that it is better for some one else to own the land, and grow the timber. The company will buy the logs.

Just what is the situation in North Carolina? In the first place, timber is classed as real estate in the eyes of the lawyers and tax assessors. Timber cannot intelligently be classified as real estate unless corn, potatoes, cotton, and tobacco are also included. Timber is a crop. It produces material annually that is added to the crop of the year before, the sum of the annual crops being harvested when conditions warrant. To the tax assessor the land should be the assessable feature, not the timber.

Table 24

Region	Tax Rate	% Real Value	Timberland	Cut-over Timberland	Waste Land	Agricultural Land
Coastal	$1.30	62	$15.00	$ 7.00	$ 4.00	$48.00
Piedmont	.95	66	28.00	13.00	7.00	34.00
Mountains	1.50	62	25.00	6.00	3.00	50.00

Agricultural lands assume value on the basis of what they will produce. This is not true of forest land. Forest lands are given a value depending on what is present *on* the land. The forest land areas are classified in some counties as timberland or cut-over timberland, the latter having the lesser value. In other counties, forest land is considered along with agricultural land and an average figure per acre is the basis for the assessment. In some counties timberland has a higher assessed value than agricultural land.

In spite of the unfairness of the classification to owners of large timber tracts, taxes are not unduly high in many counties, the eastern counties having the fairest assessment on timberlands.

Average land valuations for tax purposes are shown in Table 24. These figures were compiled from 40 sample counties.

Present tax laws can be made to work fairly if they are properly administered. Inequalities frequently arise from the present assessment policies which do not consider the productive capacity of timberland as compared to agricultural land.

Generally speaking, examples of excessive taxation on large timber tracts have not been noted. Such cases do exist, but there is also a tendency on the part of many people to complain about taxes merely as a matter of principle. Some farmers in the Piedmont have the most cause for complaint when their forest land is assessed at the same value as their agricultural land.

THE TIMBER VOLUME BALANCE SHEET

The Forest Resource Appraisal did not attempt a study of growth based on new field data. The information presented on this subject is from the thorough study by the U. S. Forest Survey in 1937 and 1938. No other estimates of growth in North Carolina are available.

Table 23 shows that during the seven-year period, 1937 through 1943, the average annual net growth of sawtimber material was 2,311,000 M. bd. ft. Nearly three-fourths of the sawtimber growth was made by pine; over one-fourth was made by hardwoods and cypress. The table shows how this growth is distributed among the four regions.

Sawtimber growth apparently has not declined, although the total amount of sawtimber volume has declined. The reason for this is that heavy cutting of sawtimber trees has, in effect, swapped large trees for smaller ones. The smaller trees produce wood at a more rapid rate. It is pointed out, however, that the quality of the sawtimber growth on smaller trees is not equal in value to the same volume of wood on larger trees.

According to Forest Survey calculations, sawtimber growth was a litle higher in 1943 than in 1937. Three regions are figured to have shared in the gain, only the Piedmont showing a decrease in sawtimber growth. All changes are negligible.

The growth estimates for all sound trees 5.0 inches d.b.h., and larger, include sawlog trees, upper stems of pine sawlog trees (but not hardwoods), and sound undersawlog-size trees. The rate of growth of the sound-tree growing stock increased in the period from 1937 through 1943, all regions showing a gain except the North Coastal Plain.

Average Net Growth per Acre. Based on the stands present in 1937 and 1938, the Forest Survey calculated the net sawtimber growth for the average wooded acre in North Carolina to be 131 board feet. Loblolly pine types averaged over 200 board feet per acre while upland hardwoods were lowest, being under 70 (This fact emphasizes the desirability of growing pine where feasible on upland sites, as stressed elsewhere in this report). By regions, average growth per acre was 163, 128, 149, and 72, board feet for the North Coastal Plain, South Coastal Plain, Piedmont, and Mountains, respectively.

Average growth per acre for the total sound-tree growing stock was about ½ cord for the state as a whole. It ranged from .41 cord in the Mountains to .68 cord in the Piedmont.

Growth estimates are of necessity based on calculations.

Table 23.
FOREST GROWTH COMPARED WITH COMMODITY DRAIN *
Annual average based on 7 year period 1937 through 1943

AVERAGE NET ANNUAL GROWTH

	Sawtimber			All Sound Trees 5.0" D.B.H. and Larger		
	Pine	Hardwoods (Million Board Feet)	Total	Pine	Hardwoods (Thousand Cords)	Total
N. Coastal Plain	477	174	651	1,228	742	1,970
S. Coastal Plain	554	154	708	1,793	751	2,544
Piedmont	507	191	698	2,167	1,201	3,368
Mountains	107	147	254	448	980	1,428
State	1,645	666	2,311	5,636	3,674	9,310
AVERAGE ANNUAL COMMODITY DRAIN						
N. Coastal Plain	442	156	598	1,387	538	1,925
S. Coastal Plain	477	170	647	1,597	672	2,269
Piedmont	686	170	856	2,450	798	3,248
Mountains	112	167	279	413	697	1,110
State	1,717	663	2,380	5,847	2,705	8,552

Cypress is included with hardwoods.

*From Forest Survey Release No. 18, "N. C. Forest Growth and Drain 1937-1943," by J. W. Cruikshank and A. D. Toler.

Borings in thousands of stems determine the rate at which trees increase in volume. Through other phases of a growth study the mortality drain is computed and deducted to arrive at net growth. Growth rate changes as timber stands change in character.

A repeated inventory affords a rough check on the growth calculations, provided that commodity drain is known. The Forest Resource Appraisal in North Carolina found 6% less sawtimber than was found in 1938. This compares reasonably with the volume arrived at by projecting growth and deducting the commodity drain. The Appraisal estimates of sawtimber are somewhat lower in the Coastal Plain than would result from the projection of growth and drain. It is believed that drain was heavier than it has been figured. This would account for the difference.

STATE FORESTS

Are more public forests needed in North Carolina? This question raised opinions of approval and disapproval in the various regions of the state.

People, generally, seem to favor the additional acquisition of public forests in the Mountains. Many individuals have come in contact with the National Forests and National Parks through the medium of recreation. Many are not acquainted with the policies of forest management on either the National Forests or National Parks, but as these areas have a high esthetic value the people are in favor of further acquisition.

Lumber companies have, in the past, welcomed the idea of selling their cutover lands to the Federal Government. This trend continues and, as a result, more land will likely be acquired in the Mountains for National Forests.

In the Piedmont, various community leaders did not think that public ownership was feasible due to the absence of large, unbroken timber growing areas. Units large enough for National Forest Ranger Districts are practically nonexistent. However, the opinion was expressed that state forests could well be established in several sections of the Piedmont. These forest areas should be established to show landowners the best methods of managing their timber growing areas. The educational value of these demonstration forests would more than pay for the cost of establishment. There are forest lands in the Piedmont that are suitable for State Demonstration Forests and it is hoped that sentiment will develop for their purchase.

The Coastal Plain has many areas of variable size that seem suited to public ownership. Here, again, state ownership was suggested for all areas with the exception of the Great Dismal Swamp. Lumber and pulp companies are more interested in the "better" types of timber growing land. The state could well afford to acquire lands in the Coastal Section. Certain pocosins, sand ridges, and swamp areas are well suited for public ownership. These areas are not attractive to lumber and pulp companies at present, but do have future value for timber production if placed under protection. Here, again, demonstration of forestry practices would be of untold value in showing landowners what could be done with these unattractive areas.

It is believed that the State of North Carolina should own and operate State Forests for timber production and demonstration. These State Forests should be located chiefly in the Piedmont and Coastal Plain as it is too late to compete with the Federal Government in much of the Mountain region.

North Carolina can hardly afford to stand by and allow more of her potentially good forest lands to be taken up by the Federal Government. There are too many advantages in state ownership. With State Forests go prestige, training facilities for personnel, proving grounds for techniques, demonstration and research areas, an influence with personnel which makes the job more interesting to the men, and, last, but not least, financial returns.

Probably there are few fields in which the Southern States are losing their birthrights so rapidly as in the matter of forest lands. Once the Federal Government acquires these lands, there is the danger that the people of the state will have no further responsibility and little influence in connection with them. It is just that much of the state's territory lost. State sovereignty has lost in a field where its manifestations should be strong.

There are plenty of precedents establishing the wisdom of state forests. Several states have had state forests for more than forty years and are continually expanding. These states realize the value of their forest areas and have acted accordingly. New York owns approximately 3 million acres; Michigan owns over 3 million acres; Pennsylvania owns over 2 million acres; Minnesota, Oregon and Washington all own over one million acres of state forest lands. Most of the state forests in the United States have been created from cut-over lands and on them are found some of the best forestry practices in the country. These forests have been highly successful and have won public favor.

EDUCATION OF FOREST LANDOWNERS

Nearly 17 million acres of North Carolina's forest land are in the hands of private owners. Since, as in agriculture, the manner in which the crop is handled affects the yield, it is in the interest of the general welfare to inform these owners regarding good practices, and to assist and encourage them by all suitable means. Cotton farmers have been enabled to double their yields per acre through application of scientific practices brought to them by agricultural teaching, extension service and research. It is not too much to hope that over a long period of years timber owners with reasonably good forest land can be led to double their timber yields.

In using the term "education" it is intended to include various kinds of assistance which have developed in connection with farm programs; not merely giving a talk or handing out a circular, but service in marketing, planning, and other ways.

STATUS OF FOREST MANAGEMENT

Public forests. Forest maangement is well developed on the one existing state forest, and beginnings have been made on a large state game refuge near the coast. The 84,000 acre forest of N. C. State College is being managed on an intensive basis, and all costs, including purchase price of the land, are being met from income made by the forest. Watershed forests of municipalities are protected from fire, but are usually not under management, the present policy on most of them being to refrain from timber cutting.

National forests are said to have intensive management and are well protected from fire. It has been difficult to make much progress with scientific forestry on the three-quarters of a million acres of national forests in the

Mountains. They are hardwood forests and, like hardwood forest everywhere in the state, contain so much low-grade and cull material that growth of better trees is impeded. It seems likely that yields of timber on national forests have improved little, if any, over yields on similar private lands. They may have more timber because they cut less. Selective cutting seems to be Forest Service policy for these forests, and must undoubtedly be one good way to harvest, but numbers of foresters will argue that clear cutting is just as good or better for Mountain hardwoods. They point out that the best hardwood stands in the Mountains, excepting old fields, both on national forests and on private lands, are on the areas cut most completely years ago. The national forests are building up their stands. This would seem to be an appropriate function of public forests; to hold a good volume of timber for periods of emergency.

Industrial Owners. They own over 1½ million acres in North Carolina, mostly in the Coastal Plain. Pulp mills, with over ½ million acres, are either practising intensive forestry or preparing to do so. They employed 13 foresters in North Carolina in 1944, three times as many as the more numerous lumber companies. Pulp companies cut their lands conservatively (much land is not being cut at all) and are trying to protect them from fire. This latter problem is the more troublesome for them because their holdings are scattered.

Lumber companies own over ¾ million acres. Of this acreage, however, not over ⅓ can be credited with intensive management; that is, systematic management aimed at increasing yields. At least ½ million acres are in the hands of companies which have "cut out" and are still holding the lands, undecided what to do next; or are still cutting without particular efforts toward better practices. There are two large lumber concerns in eastern North Carolina that seem to be energetically pushing ahead with land purchases and purposeful forestry practices. A number of smaller mills are working along the same line, and many more are becoming convinced that they should. Most industrial owners are trying to protect their lands from fire, although with some the effort does not lead to fire lines, etc. on the ground.

Farm and Investment Ownerships. These two groups own about 15 million acres of forest land. Possibly ¼ of the acreage is in holdings over 500 acres in size; most of the others are less than 100 acres. As one moves westward from the coast, average size of the forest ownerships becomes smaller.

County agents, U. S. Soil Conservation Service technicians, and public foresters were asked how these private, non-industrial owners are managing their woods. These men who know their country landowners are not inclined to credit more than 7 or 8 percent with intensive management. To earn this rating an owner would be the sort who cuts culls for firewood, tries to protect from fire, and either designates the trees to be cut in commercial sales, or in some definite way makes provision for another good crop of timber.

It must be said that these ratings are apt to be confusing. In judging a farmer's woods work, foresters or agricultural workers are naturally going to judge his work according to whether or not he is following their prescriptions. Very often a farmer following no particular prescription at all happens to have the best timber stands in the country. He may have an old field pine stand, or he may have cleancut for tobacco wood by small patches and got perfect reproduction of pine or desirable hardwoods. It is felt that in most counties owners have little better than 7 or 8 percent of their stands in fairly good condition.

The rating, however, can be said to indicate the number of owners who will today get out and pursue positive measures to improve their woods.

Questionnaires and personal contacts with the above farm advisors brought out the fact that they think about ½ of their woodlands suffer from destructive cutting; that is, cutting that makes no provision for the next crop and supposedly leaves the land in poorer shape to grow another crop.

According to results from plots taken on timber cuttings, slightly over 50 percent showed destructive cutting practices, especially as to the removal of all pine seed sources.

Another type of damage arises from the over-cutting of small trees that are just reaching the stage when new volume production is greatest.

It will be apparent from reading this report that there is very little forest management being practiced in the state which is effective in regenerating pine, except where pine comes in on abandoned fields, from grazed areas, or accidental disturbances. Therefore, the recommendations being offered to landowners do not offer a solution to one of the principal problems. Forestry agencies are becoming more aware of this fact and it is a certainty that efforts will be redoubled to develop lines of approach that will maintain pine. Research has not been active enough on the most critical problems that confront private owners.

EDUCATIONAL EFFORTS TO DATE

Extension Service. Great progress has been made in forestry educational work since R. W. Graeber was appointed Extension Forester of North Carolina in 1925. For ten years he carried on educational work with farmers, working alone insofar as the Extension Service was concerned until 1935, when an Assistant Extension Forester was appointed. Regular Extension Service educational work was followed by demonstrations and meetings of farmers, and information disseminated by mail.

In December, 1942, the Farm Forestry Program was initiated and six field men were added to the staff. This program was developed to assist farmers and to aid the war effort. Farmers were assisted in the systematic management of their forest lands to keep them productive. They were aided in the making of timber sale contracts, finding markets and buyers for their products, and in the development of marketing cooperatives when needed.

The war effort was aided by making a great deal more lumber and pulp material available for use, material that otherwise might not have been utilized due to lack of knowledge of markets or procedures.

This program has been continued and extended. There are now eight Farm Foresters working in 31 counties and the program not only includes the above points concerning marketing, but also technical assistance and planning is now offered in thinning and stand improvement, selective harvest of merchantable timber, pruning, planting, and protection from fire, diseases, and insects.

Not only farmers, but some mill operators realize the value of the program. Graeber said, "A large number of mill operators are working closely with our farm foresters and are seeking their help. They often refer timber owners to the forester before buying."

For the fiscal year 1944-45, the Farm Foresters gave assistance in timber marketing to 686 farmers who sold $708,006 worth of material from 73,337 acres of forest land. Timber was actually marked and volume determined on 415 farms or 24,846 acres. The volume marked was 68 million board feet of sawtimber and 12,392 cords of pulpwood and miscellaneous products.

Further educational value was obtained through the spread of influence in a community by people observing and discussing work of this type.

Present plans call for the further development of the Farm Forestry Program within the next 10 years. This is now in North Carolina a cooperative project between the Extension Service (State and Federal), and the U. S. Forest Service.

DIVISION OF FORESTRY AND PARKS, DEPARTMENT OF CONSERVATION AND DEVELOPMENT

Educational work of this division, the state government's chief forestry agency, consists of several phases. Fire protection education work follows the general trend with talks to schools, radio talks from various local stations, showing of motion pictures to schools and civic groups, and the use of fire protection posters and literature. During the 1944 calendar year, 614 schools were visited by division personnel.

Various forestry services and advice are given to the absentee, investment, industrial and other owners of forest land. Federal funds, disbursed through the U. S. Forest Service, join state and county funds in this overall program.

The Bladen Lakes State Forest in Bladen County is being intensively managed as a demonstration of forestry on submarginal land. All phases of management are underway. Forest products of all types are being systematically grown and harvested. Two recreational centers have been established and two lakes developed for fishing. Regulated deer hunting in cooperation with the Game Division is now underway.

Further educational work has been undertaken in cooperation with the Vocational Agriculture teachers in various counties. In Wilson County, four units of 10 acres each have been established as school demonstration forests. The units have been donated and deeds are held by the Board of Education. Units have been established in four Mountain counties, but the lands are still in private ownership. This program was curtailed by the war, but is to be revived on a larger scale. A forester on the State Forester's staff is assigned full-time to Information and Education activities corelation.

U. S. SOIL CONSERVATION SERVICE

In 1944 there were seven foresters employed by the U. S. Soil Conservation Service in North Carolina. These men were not employed as foresters, but were used in the general farm program. However, the forestry-trained conservationists have worked forestry practices into farm plans and have been responsible for assisting many farmers in the development of their forest lands through improvement cuttings and tree planting.

Tennessee Valley Authority. At present, the T.V.A. (Dept. of Forestry Relations) has three foresters working within the Tennessee Valley in North Carolina. This organization cooperates with state, local, and other federal agencies. For the past seven years they have been assisting timber land owners in forest management and tree planting in an effort to decrease erosion on T.V.A. watersheds and for the past two years, T.V.A. foresters have been developing detailed individual management plans for certain demonstration farms. These foresters also work in cooperation with the N. C. Division of Forestry and Parks in giving technical assistance to absentee, investment, industrial and other owners on lands within the Tennessee Valley in North Carolina.

Farmers' Federation, Asheville, North Carolina. Two foresters are employed, one working on the marketing of pulpwood in an effort to obtain as much volume as possible to meet present demands by encouraging thinning and cutting; the other working with individual owners to develop a systematic management, harvesting and marketing program. Management agreements are signed with the timber owners and all future cutting is handled by the Farmers' Federation. This work is carried out on a commission basis, with further assistance from a Charles L. Pack Forestry Foundation grant.

Farm Security Administration. Under the Tenant Purchase Program of the F.S.A., some forestry educational work has been practiced with the cooperation of the Extension Service, Farm Foresters, and Management Assistants of the N. C. Division of Forestry and Parks. A number of cutting plans have been developed for individual farms and some very effective work has been done, as the F.S.A. controls farm and forest practices on farms as long as loans are in force. In spite of this "enforced" education, however, some owners have liquidated their timber to pay their mortgages.

THE NORTH CAROLINA FORESTRY ASSOCIATION

The North Carolina Forestry Association is "A Voluntary Association of Persons and Organizations Interested in the Protection and Fuller Development of North Carolina's Forest and Game Resources." This organization is very active and has developed a broad forestry and natural resources program to assist in keeping North Carolina's forest lands productive. Educational efforts of the Association deal with the development of community forests by counties, towns, and cities, an enlarged program of farm and industrial forestry education and service, a broadening of the public interest in forests through the public schools, and adequate facilities for the teaching of forestry at North Carolina State College and Duke University.

SCHOOL OF FORESTRY, DUKE UNIVERSITY

The School of Forestry, although engaged mainly in the professional training of technical foresters on a graduate level, maintains contacts with private and owners through the operation of the Duke Forest.

The Duke Forest, located in Durham and Orange Counties, consists of three main units; namely, the Durham, New Hope Creek, and Hillsboro divisions. The total area of the Forest is now over 7,000 acres. Situated on the lower

Piedmont Plateau at elevations ranging from 280 to 650 feet, and composed of second-growth shortleaf and loblolly pines, oak, gum, hickory, yellow poplar, ash, and other hardwoods, the Forest is representative of the various types of timber growth found throughout the region.

Besides serving as an outdoor laboratory for the School of Forestry, the Forest is managed with the objective of demonstrating the various methods of timber growing, timber stand treatment, and forest management applicable to the region and of developing it as an experimental forest for research in the problems of timber growing and in the sciences basic thereto.

The development of the Forest as a demonstration of practical forest management is well advanced. Forest type and timber stand maps are available for each of the three divisions and a detailed soils map is being prepared. Each division has been subdivided into permanent compartments and plans for the treatment of each stand have been made.

Various products are harvested each year such as sawtimber, poles and piling, veneer bolts, pulpwood, Christmas trees, ornamental stock, and decorative material. Cutting operations, within the limits of annual growth, are so designed as to illustrate approved forestry practices such as selective cuttings, strip cuttings, seed tree cuttings, thinnings, improvement cuttings, conversion operations, and many others. These operations serve the dual purpose of contributing to the development of the Forest as a going business and of demonstrating sound forestry practices. Land owners, farmers, and others interested in seeing and learning about these forestry demonstrations visit the Forest singly or in groups.

DIVISION OF FORESTRY, N. C. STATE COLLEGE

The Division of Forestry is primarily engaged in the training of technically trained foresters; however, educational contacts with private land owners are maintained through the various forest areas owned or operated by the Division.

The Hill Demonstration Forest of 1,500 acres, located in Durham County, is primarily a research forest. Many sample plots have been planted that demonstrate various spacings of loblolly, shortleaf and Virginia pines. A number of thinning plots in Virginia pine have been established to show silvicultural methods of handling this species, and thinning plots in hardwood for fuel and improvement have been initiated.

The Hofmann Forest of 80,000 acres located in Jones and Onslow Counties is owned by the N. C. Forestry Foundation and operated by the Division of Forestry. Various commercial operations dealing with pulpwood and log production are underway. A completely equipped weather station has been established on the forest by the N. C. Experiment Station in connection with fire studies. Forest grazing studies on a commercial scale are being conducted by the Department of Animal Husbandry, N. C. State College, U. S. Forest Service, and Bureau of Animal Industry, Washington, D. C., on a cooperative basis.

Other units on which forestry work and demonstration are well underway are the Richlands Creek area of 300 acres in Wake County and the Hope Valley Forest of 1700 acres located in Chatham County.

It can be seen, from the above discussion of agencies concerned with forestry education, that this type of work is and has been steadily progressing since appointment of J. S. Holmes as first State Forester in 1909. This phase of forestry is, however, far from being adequate. There are thousands of landowners who have been contacted in no way whatsoever. It is estimated, by various agencies, that at least 25 percent of the owners of private forest lands would not respond to forestry education and assistance if offered. Forestry education should be expanded, however, so as to reach the other 75 percent. If this could be accomplished, North Carolina's future timber needs would be insured. Education should be given a fair chance before concluding that government regulation is the only solution to the problem of keeping our forest lands productive.

In 1943, approximately 1,600 million board feet of lumber were cut from the 17 million acres of privately owned land. Of this amount, probably 300 million board feet were cut under the influence of some educational work, either by actual marking, advice or demonstration. The remaining 1,300 million board feet were cut for no reason except to make money. Can it thus be said that forestry educational work has been given a fair trial?

ALLOWABLE CUT FOR NEXT 10-YEAR PERIOD 1946-55

During the past 10 years North Carolina forests have grown 23 billion board feet of sawtimber material. It is estimated that nearly 24 billion board feet of sawtimber material has been removed from these forests. Possibly, too, the drain has been higher than estimated.

How much sawtimber material can be safely removed in the next 10 years? A number of points bear on this question, which might be answered very conservatively by some and quite liberally by others. The more orthodox claim is that growing stock is depleted and should be allowed to build up, which would mean restricted cutting. In a general way, this is certainly true. At the same time, Dr. J. V. Hofmann, of N. C. State College Division of Forestry, points out that a great deal of the timber in our stands is near-cull or definitely low-grade, and this kind of timber needs to be cut heavily, even if it means clearing everything off the ground but pine seed trees. This would apply more to hardwood trees than to pine, but he feels the principle applies to more pine stands than is ordinarily thought.

Another angle is the fact that the timber, even if not greatly reduced in volume, is now in more scattered stands that are not attractive to sawmillers.

If restricting the cut were a means of securing greatly increased regeneration of pine, the matter would assume higher importance. However, it is not more than a short step in that direction if, indeed, any forward movement were to result. Heavier cutting offers no particular help, either.

A forester of the U. S. Forest Service writes: "Overcutting in merchantable stands has increased in this section due to war conditions. So far, it is my opinion that there has been no solution advanced that will improve the situation. It is true that the cutting practices outlined by the Society of American Foresters Committee will defer the final destruction of the pine for some time. However, there has been no proposal made that will regenerate pine on sites where there is any appreciable hardwood understory."

Since the total sawtimber stand is shown by Appraisal figures to have declined 6 per cent in the last 8 years, we might base our allowable cut for the next 10 years on the premise that the deficiency be restored.

The rate of sawtimber growth is now about the same as it has been for the past 10 years. The rate, 2.3 billion board feet annually, seems to have over-cut pine by about 12 per cent in the last 10 years. For the next 10 years an under-cut of 12 per cent would build back the pine growing stock. Following these assumptions, the annual cut of sawtimber material would be 2.0 billion board feet.

Hardwood cutting could go on as before. It is the pine that needs to be replenished.

The calculations are believed to be on the conservative side, inasmuch as under-sawlog-size volume is increasing.

CONCLUSION

1. The major problem confronting foresters in North Carolina is the successful reproduction of pine on lands that are better suited for growing pine than hardwood. Hardwood succession is a natural condition being hastened by present systems of cutting. As pine will produce approximately three times the volume of hardwood under average conditions, something must be done to insure the reproduction of pine if the state is to maintain its high production of lumber. Decrease in pine volumes will become serious following the maturing of present under-sawlog-size trees. Although there is a fair percentage of pine in the sawtimber and under-sawlog-size at present, only 27 per cent of the reproduction is pine. Pine volumes have remained high in the past due to fire and land clearing and abandonment. Complete exclusion of fire and a land-stabilized agriculture will mean a serious reduction of pine volumes. The Mountain region is excluded from the above discussion as this area is predominantly hardwood forest.

2. The fire problem in eastern North Carolina must be met by the State as a whole. It is felt that state-wide fire protection is a necessity and that fire control measures cannot be adequately provided under the present system of voluntary county cooperation. Provision for establishing and financing a state-wide system must be left to the General Assembly.

3. The accumulations of hardwood cull trees and brush are forming an ever-increasing barrier to the development of good timber trees. These accumulations are the cause of the non-stocked condition of approximately 2 million acres of forest land in North Carolina. Development of new bulk wood-using industries will be necessary before the present volume of 41 million cords of usable cull trees can be decreased.

4. Thousands of acres of good pine growing lands are non-stocked because of the complete removal of pine seed sources. A provision should be made to retain a source of pine seed.

5. The forestry educational program should be expanded so that more of the 200 thousand landowners might benefit through a knowledge of good forestry practices.

6. State-owned forests should be established in the various regions of the state. State ownership would develop prestige, give training facilities for personnel, provide proving grounds for techniques, demonstration and research, and demonstrate financial returns. Enabling statutes already exist, as part of the legal framework of the N. C. Dept. of Conservation and Development.

7. The total sawtimber stand has declined approximately 6 per cent in the last eight years. If possible, this deficit should be made up by slightly reducing the cut of pine, as the pine volumes have been reduced about 12 per cent. Hardwood cutting could go on as before.

8. No definite conclusions have been reached concerning the public regulation of cutting on private lands. Public opinion was divided between federal or state regulation, and no regulation at all. It is felt that no regulations are necessary for hardwood timber, but that some means should be employed to save a source of pine seed.

9. Research is very definitely needed to determine the benefits or detriments of prescribed burning to re-establish pine on certain lands in this state. Burning techniques have been developed in other states so it is reasonable to suppose that techniques could be determined here.